

# ALLAN HANCOCK ATLANTIC EXPEDITION

REPORT NUMBER 2

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BY

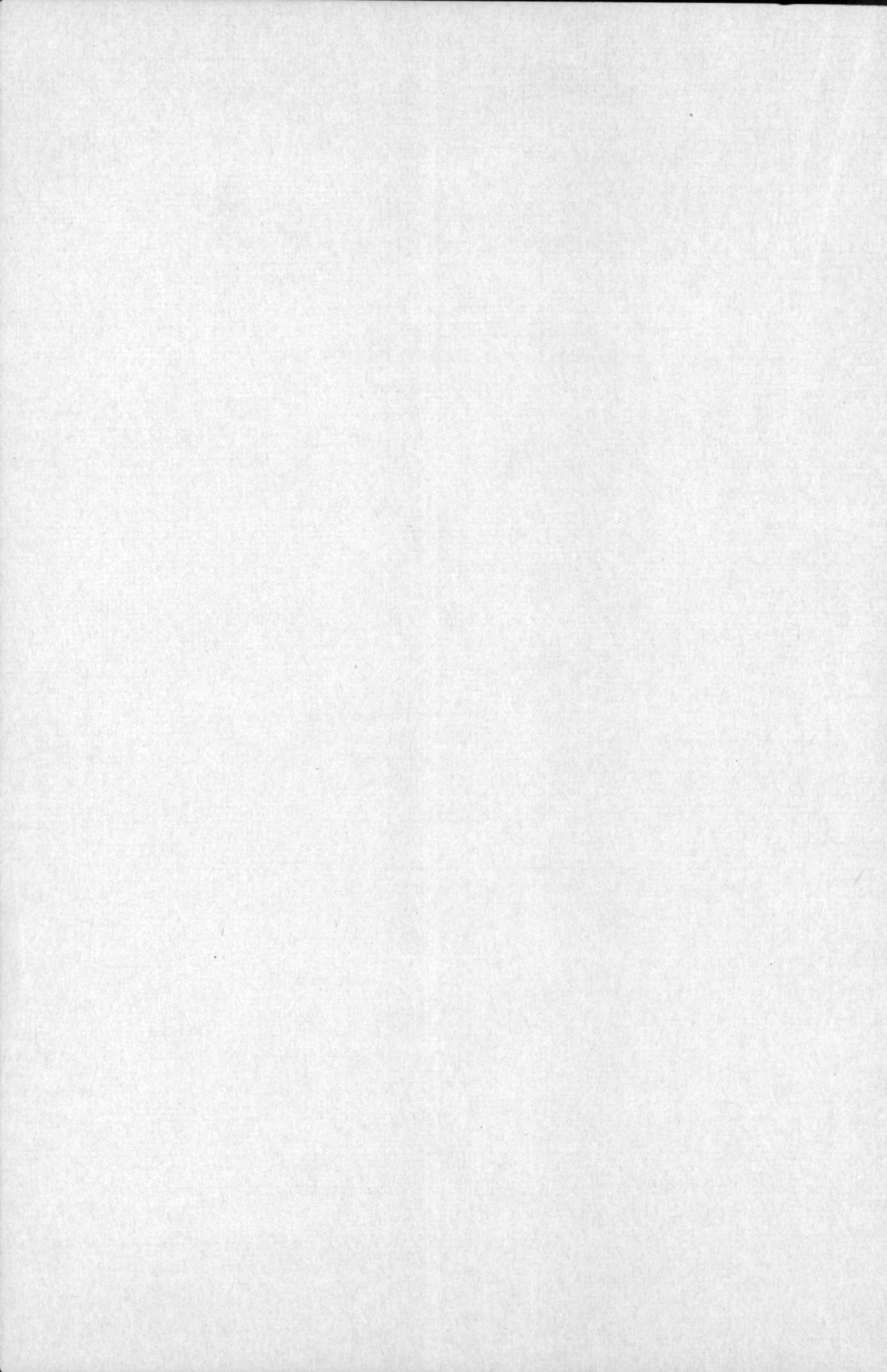
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## CARIBBEAN MARINE ALGAE OF THE ALLAN HANCOCK EXPEDITION, 1939

WILLIAM RANDOLPH TAYLOR

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The Allan Hancock Expedition of 1939 spent approximately one month in Caribbean waters. This was the first foray into this area under Hancock auspices, for previously this organization had concentrated on Pacific coastal districts and outlying islands. However, the flora of this Caribbean area being more familiar to the writer, his longer experience with it has induced him to prepare a report for publication before an account of the western materials was ready, and separate from the account of the Pacific Coast portions of the 1939 collections.

It is not possible to attempt here a sketch of the history of the study of Caribbean marine algae. As usual these plants have failed to attract the undivided attention of botanical travelers. Nevertheless, even earlier botanists picked up some of them as curiosities of the sea, and brought specimens to their European sponsors. A number are mentioned, frequently with reference to earlier publication, in Dawson Turner's "Historia Fucorum" (1808-1819). The introductions to many of the works on West Indian plants, such as those by Børjesen (1915-20), Howe in Britton and Millspaugh (1920), and others, serve to cover the story in part, but many small collections which reached European herbaria in years past have never been adequately dealt with. Perhaps the chief compilation of records is that of Murray (1888-89), who added many not previously published, based on specimens in the herbarium of the British Museum (Natural History). It is not a critical list, for he accepted records without much attempt to eliminate incorrect identifications or obsolete synonyms. The present writer has published several more or less comprehensive accounts of the algae of parts of this area (1926, *ff.*).

The areas reached by the 1939 Expedition were ones particularly ill known. Studies in the past have dealt only casually with other than a few places. Those best known outside of the United States have been: Bermuda, the Bahamas, Jamaica, Puerto Rico, the Virgin Islands, Guadeloupe, Barbados, and Brazil. Other countries have been visited and some have been mentioned in published lists, but without adequate series to show the character of the flora. We have been able to add materially

to what is known of the marine algae of Panama, Colombia, Venezuela, and the Netherlands West Indies; and, while the proportion is perhaps less, still a number of interesting observations were made on the marine flora of the extreme southern British West Indies.

The first stop after transit of the Panama Canal was at Caledonia Harbor, Republic of Panama, and another visit was made before returning to Cristobal (3, 4, 26, 27 April). This is a large and well-protected bay with many guarding islands, and it was impossible to make a comprehensive survey of the whole shore line. Near the entrance to the harbor the shore is broken into curving sandy beaches separated by rocky points and ledges, with the coastal land relatively low. Farther into the harbor there are muddy shallows and shores. Certain of the small islands here were completely covered by settlements of San Blas Indians, to the practical exclusion of vegetation. The ship anchored in the southeast end of the harbor, and shore collections were made from rocky ledges and sandy shallows near Isla Piedra and I. San Augustin.

In addition, among the outer islands there were shallow lagoons partly surrounded by mangroves, and these yielded collections typical of this environment. Altogether, Caledonia Harbor was an extremely satisfactory station, with a great variety of algae in excellent condition, and produced over a hundred numbers, the greatest from any one place during the trip. The flora was not marked by particularly unusual items; it was on the contrary very typical of its district with an abundance of relatively common species. Most of these are, however, recorded for the first time from Panama.

The tide-pool rocks and sandy pockets showed *Caulerpas* (seven kinds) in abundance; higher, and in part emergent at low tide, were mats of yellow *Gelidiella acerosa* in which *Chaetomorpha brachygona* was entangled, olive *Laurencia papillosa* and green *Dictyosphaeria cavernosa*, with tufts of bright green *Chaetomorpha media* somewhat whitened at the tips by the discharge of swarmers. Just over the edge of the reefs *Turbinaria* and *Sargassum* formed large beds, *Dictyota ciliolata*, *Galaxauras*, *Laurencia obtusa*, *Acanthophora spicifera*, and *Hypneas* crowned projecting rocks. The broader sandy shallows in more protected areas were the favored localities for abundant colonies of *Halophila*, *Halimeda*, *Rhipocephalus*, and *Penicillus*, and, forming a fringe bordering the sand on rocks and shells, *Padinas*. In one particularly warm, shallow, and rather muddy pool brownish tufts barely emergent were found to be the tips of plants of *Avrainvillea Rawsonii*, which grew partly buried in the



sand. Little time was spared to the less accessible mangrove lagoons. In the one visited there was relatively poor algal development. The submerged roots of the mangroves yielded the expected *Catenella* and *Bostrychia* colonies, and splendid plants of *Udotea Flabellum* were common on the muddy bottom. The lagoon was reached from its innermost end; if it had been possible to visit its connection with the sea, a more varied flora would probably have been found.

Collections at the Netherlands West Indies were made on Aruba Island (10 April) and at Curaçao Island (22, 23 April). The *Velero III* anchored at St. Nicholaas Bai on Aruba Island, but the harbor was so foul with petroleum waste that all of the successful collecting was done in the little cove at Punta Basora. Here a curving breakwater protected a sandy harbor which was shallow for a considerable distance from shore. The actual shore line was rough and stony, with tide pools and shelving rocks. The rocks were notably pitted and perforated. All these factors favored algal growth. On the other hand, tarry wastes from the local petroleum industry often permeated the sand, despite which the algae seemed able to grow quite well even when, lifted for study and mounting, the black sticky material was abundant enough to make preparation difficult and untidy.

The shelving rocks were commonly yellow with *Gelidiella* and dull green with *Laurencia papillosa*, and occasionally were covered with colonies of *Sargassum vulgare* or of dwarfed *Turbinarias*. Only in the more protected crevices with good water circulation toward the southern end were fruiting plants of the latter found. In shallow pools in the same area *Sargassum platycarpum* dominated, while elsewhere *Caulerpa sertularioides Farlowii* and *Padina gymnospora* were more common. On the more exposed rocks were abundant colonies of *Hydroclathrus*, wiry *Chaetomorpha media*, pale green *Cladophoropsis*, and the darker *Cladophora fuliginosa*. On the inner side of the breakwater there was a heavy growth of *Ulva fasciata*.

At Curaçao Island, Valentijn's Bai, the inner harbor of Willemstad, where the *Velero III* anchored, was most unpromising, as rubbish could be seen to line it, covered with tarry wastes. However, Mr. Elmore in one brief trip, incidental to his phanerogam collecting, brought back a good pail of algae. Here again it was clear that these plants resisted such conditions well. From the rocky shore below the harbormaster's signal station he secured abundant *Halimeda tridens typica* and *H. Opuntia*, *Caulerpa taxifolia*, *Dictyota linearis*, *Acanthophora*, and *Dasya pedi-*

*cellata*. On the *Acanthophora*, *Erythrotrichia* and *Callithamnion* were abundant. It then appears as if, had time been given to it, varied and rich collecting might successfully have been undertaken here.

On the other side of the town near the pontoon bridge, where the water was relatively pure, it was obvious that there was a good littoral growth of algae. Opportunity not developing to collect thoroughly, one quick sampling was attempted and the proceeds brought back in paper. The flora appeared to be dominated by Gracilarias, *Ulva fasciata*, and Padinas.

Attempts by car to reach good rocky shores well removed from the towns and pollution were impeded by unfamiliarity with the district and restrictions imposed by owners. However, it proved possible to obtain access to a bathing establishment at a place known as Jan Thiels Beach, and from it to work along shore to very satisfactory sites. Enclosed tide pools were not a feature of the topography, but large and broken rocks afforded good protection to the algae and, unfortunately, to an unusual multitude of *Diadema* sea-urchins, which made collecting very hazardous. A form of *Sargassum vulgare* was extremely common, and with *Dictyota dentata* and *Chnoospora pacifica* dominated the Phaeophyceean flora. As usual, the most prominent Chlorophyceean was *Ulva fasciata*, but the rocks bore colonies of *Caulerpa racemosa* and abundant close mats of *Cladophoropsis membranacea* as well. As in most places exposed to surf, this mat vegetation was important; from the denser firm elements composing it softer species project. These would include tufts of *Ectocarpus Duchassaingianus* and *Wrangelia Argus*, both very common. With the *Cladophoropsis* other common firm-matting species were *Centroceras clavulatum* and *Spyridia aculeata*. Except in mass these were, of course, inconspicuous. More prominent Rhodophyceae were *Liagora ceranoides*, of which small plants were common, and *Laurencia Poitei* forming dull but large clumps. About 35 species were secured here in the single visit, in spite of the fact that we were not able to take advantage of the entire period of low water. Of incidental interest was the flora of a large concrete bathing pool which was apparently not in use. The deeper end was quite muddy and so were the sides. In this water, rendered very warm by noonday sun, there was a heavy growth of a variety of *Caulerpa sertularioides* (f. *corymbosa*) and of *Hypnea cervicornis*.

Tortuga Island, Venezuela, lies about 45 miles off the mainland and is about fourteen miles long and half as broad, so that it represents quite a considerable site for study, of which we were only able to avail ourselves

in small part. The algal collections were made on the rocky shore near Punta Arenas. This point is at the western end, is long, low, and, as its name indicates, sandy. Where it expands to the main island a mile or so from the tip, the land rises and old rocks of coral origin extend from water of moderate depth to the shore. Back of this lies a beach of fine white calcareous sand, and from it the ground forms a steep bank to the upland, which is a rather sandy expanse of cactus and thorn scrub with sparse grass.

The shoreward rocks supported a vegetation of *Enteromorpha*, appearing as a low green belt. With it was *Chaetomorpha media*, and *Bryocladia thyrsgera* in blackish tufts. A little farther out were extensive beds of *Sargassum*, *S. vulgare*, *S. linifolium*, and *S. Filipendula* being represented, with *Padina Vickersiae* in shallower pools. The most striking feature of the location was, however, the large drift of seaweed floating and washed ashore. This was characteristic material of submerged, old coral reefs or other rocky substrata. There was no reef within view of our part of the Tortuga Island shore, but from the boat it appeared that there were a coral bed and certainly a heavy algal growth between Los Tortuguillos islets. The character of this growth was not sampled by dredging, but perhaps the algae washed ashore came from this area. Full advantage was taken of the excellent opportunity to sort and secure good specimens. Notable elements in the driftweed mass (which naturally was dominated by *Sargassum*) were as follows: in Chlorophyceae *Ulva fasciata* was frequent; in Phaeophyceae only *Dictyopteris delicatula* was abundant with the Sargassa; in Rhodophyceae, however, several species were noteworthy. The group in greatest abundance includes *Laurencia Poitei*, *Lophocladia trichoclados*, *Delesseria Hypoglossum*, *Hypnea musciformis*, *Spyridia aculeata*, and *Halymenia Floresia*. Very frequent also were *Bryothamnion triquetrum*, *Agardhiella ramosissima*, *Gracilaria damaecornis*, and *Griffithsia globulifera*. This was a good station, too, for relatively rare items, and enriched the list exceedingly, for over 25 plants secured here did not, on this expedition, turn up elsewhere.

Cubagua Island, Venezuela, near the pearling center Margarita Island, (14, 15 April), is a place rather similar to Tortuga Island, but less than half as large. In the absence of a prominent drift the collection was chiefly limited to plants *in situ*, with a rather more limited assortment. The shore line shows considerable areas with exposed rocks in more or less level beds giving good attachment for algae, the Chlorophyceae especially forming an evident luxuriant intertidal zone. Behind

these shore rocks terraced banks lead up to the slightly undulating but never high inland area, where the reddish soil is covered with sparse grass, thickets of *Opuntia* and other cacti, *Acacia* and other thorny shrubs, occasionally overtopped by a moderately large *Cereus* cactus.

The algal vegetation was, in the intertidal zone, dominated by Chlorophyceae. The evident color was afforded by *Enteromorpha flexuosa* and *Ulva fasciata*, but in a little deeper water there was prominent growth of *Cladophora fascicularis*, *Caulerpa sertularioides*, and *C. racemosa*. Larger Phaeophyceae were not very important, as shown by the few collections made of this group, but the widespread *Padina Vickersiae* was very common and *Sargassum Filipendula* was also abundant. Rhodophyceae *in situ* were more important than on Tortuga Island, where they were chiefly collected in the drift. This was probably because of the more stable character of the rocky bottom. Very abundant were *Gracilaria confervoides*, *Laurencia papillosa*, and *Hypnea musciformis*; frequent also was *Bryocladia* in the intertidal area with the *Enteromorphas*, *Grateloupia filicina* and *Gracilaria mamillaris*.

An account of the shore collecting on Tobago Island must be divided into two parts. The ship anchored off Scarborough in Rockly Bay and found with the wind prevailing that landings with the motor launch were somewhat rough. This bay is open, with a rocky shore on the western side but sandy about the rest, with only scattered rocks. Under such conditions a considerable mass of algae was adrift and lying close inshore, although the accumulation on the beach was not great. Since the ichthyologist needed fish, the launch brought in skiffs; and a seine haul, with the co-operation of the otherwise unoccupied villagers, was made on the beach. Naturally a quantity of algae came ashore in the net, and from this mass a selection was readily made. Presumably most if not all of it derived from the bottom flora in the outer part of Rockly Bay and the neighboring shores. Except for *Sargassum vulgare*, which was common, no other brown or green algae appeared abundantly. Most of the driftweed was of Rhodophyceae, with a peculiar form of *Agardhiella tenera* and *Galaxaura marginata* very common.

A much more important collection was made possible by a trip across the island. By car the party reached Buccoo Bay, and there it was possible to secure the services of a local fisherman to take us to the reef. The prolonged negotiations for and assembly of the little crew taking some time, the writer examined driftweed and vegetation on the rocks near the shore of inner Buccoo Bay. The vegetation here was rich, but time too



short to examine it fully. Considerable growths of *Hormothamnion enteromorphoides*, *Ulva fasciata*, *Caulerpa cupressoides* v. *Lycopodium*, *C. sertularioides*, *Sargassum vulgare*, and *Acanthophora spicifera* were noted. In addition on the beach significant amounts of *Dictyopteris Justii*, *Galaxaura obtusata*, *Gracilaria cervicornis*, *Cryptonemia crenulata*, and *Ochtodes secundiramea* indicated their near-by abundance.

On the way out to the reef we passed by a tortuous course through very shallow water over a brilliant white bottom of calcareous sand. In places this was marked by great masses of *Lyngbya majuscula* more or less buoyed up by gas. The reef itself was intensely interesting, though not as rich in algae as we had expected. Tide being on the flood, the outer living face was not freely accessible, for heavy rollers were pounding upon it. In shallower water nearer the crest there were splendid *Caulerpa* beds, especially *C. racemosa* of various forms, and mats of *Gelid-iella acerosa*. In the deeper tide pools on the dead reef crest there were a few things of importance, especially *Phormidium Crosbyanum* in blood-red, extremely soft masses on other algae, and *Symploca hydroides*. On the inward face of the reef there were great areas of *Halimeda Opuntia* and *Porites* coral, the latter much overgrown with *Lithothamniae*. Unexpectedly, several quite large coenocytes of *Valonia ventricosa* were found growing almost completely immersed in the denser *Halimeda* masses. Probably this plant, of great utility in physiological experimentation as well as interesting systematically and cytologically, is quite common here. In somewhat deeper water there were many clumps of *Acanthophora spicifera*; but, since the inner face of the reef was separated from the white sand shoal by only a slight drop, there was little chance for any of the characteristic rock vegetation of a sheltered bay.

The returns of algae from dredging activities deserve to be described separately. Part of the work was done from the *Velero III*, and this was carried on by the professional crew in the interests of the greatest number of scientists aboard, chiefly zoologists. As a result, most of the hauls were on sandy or muddy bottom essentially unproductive of algae. However, when a shelly or stony bottom was found, the writer was immediately available to select the algal material and care for it. It is unusual to find conditions in really deep water suitable for the growth of algae, and consequently it is not surprising that on this trip the deeper hauls all failed to produce significant algal specimens.

In somewhat shallower water than was safe for the *Velero III* a motor launch with built-in dredging hoist was used. On a previous trip the

writer accompanied the launch parties and assisted in the work, but this time he was so engaged in shore collecting that it was necessary to leave the algae which came up in the dredge to the zoological assistants, who reserved the material in pails for him to sort. Frequently considerable very good material was secured, but it could not be handled as promptly as when the phycologist was along, nor could he exert any very direct influence on the selection of areas chosen for dredging. Since stations were dredged at many stops, including some where no landing was made, only a general account of the collecting can be offered. At no one place was sufficiently widespread and systematic dredging possible to make practicable a full description of the bottom flora of the district. The samplings were essentially casual.

Dredging in Caledonia Bay reached 25 meters with profit as to algae. The variety secured added little (importantly only *Halimeda discoidea*) to the local list. Off Cienaga, Cabo LaVela, and Bahia Honda, Colombia, extensive *Sargassum* beds were met in shallow water, with few but characteristic associates. At the latter place a greater variety appeared, with *Halymenia*, *Chrysomenia*, and other Rhodophyceae. Here again the effective dredging reached only 24 meters.

Off Aruba Island, Netherlands West Indies, at 43 meters a very rich haul was made. It was mostly of Rhodophyceae in good variety, two species, *Plocamium brasiliensis* and *Platoma tenuis*, previously being known only from off the Brazilian coast, and some of the others being quite unusual. Off Cubagua and Tortuga islands, Venezuela, Trinidad and Tobago islands of the British West Indies only shallow depths were sampled, and no deep-water forms appeared in the small variety secured; so these added little to the total list.

Beyond these few remarks detailed discussion of the places visited is hardly profitable. It is expected that exact data regarding each station will be published in a separate volume of this series, and that general biological descriptions of the areas will appear with them. In generalities regarding the algae only a little may be said on so short acquaintance with the flora of so large an area. It has been known for some time that the algal flora of the Panamanian shores close to the Canal was not rich in macroscopic marine algae, the rocks when present being more or less mud covered. In 1933 the writer reported on small collections made by C. W. Dodge and his party about 150 miles west in the vicinity of Boca del Toro, Columbus and Provision islands, which indicate that the flora there is considerably better, and now the flora in Caledonia Harbor about

as far to the east proves quite rich indeed. Just how local this sterile area is does not appear, but no doubt there are good shores much closer than those recorded. The stations visited on the islands near the mainland all showed good vegetation within the limits of the character of the bottom, always a typically Caribbean flora. The hypothesis offered by George Murray (1888), that the flora of Grenada has few Rhodophyceae because the water about it is diluted by fresh water from the Orinoco, is contradicted by the large proportion of Rhodophycean records given in the writer's 1929 and present papers from Tobago and Trinidad, even nearer the mouth of the river. The uniformity of the flora of the whole area from Florida to eastern Brazil is emphasized again. Even though the variety at one spot may vary nearly totally from that in a similar spot in a neighboring cove, still the same species and the same variations in associations will appear without significant discontinuity from one extreme of range to the other. One result of dredging on the present trip has been to duplicate the records of a few deep-water Brazilian species much farther north, and no doubt as studies multiply there will be fewer apparently local species within the district. Only in northernmost Florida, the Carolinas, and Bermuda, on the one hand, and southernmost Brazil, on the other, do enough different species appear to make the floras, while still clearly tropical, somewhat distinctive.

The writer is greatly indebted to Captain Hancock for the opportunity to accompany the 1939 Expedition, and for the kindness and assistance given by him and his crew in the collecting of material. The writer also desires to express his thanks to Dr. Francis Drouet for contributing the notes on the Myxophyceae, to Dr. H. T. Croasdale for preparing the Latin descriptions, and to many others who have helped in various ways. Particularly helpful have been those who have afforded opportunity to compare herbarium specimens, as Dr. W. R. Maxon of the U.S. National Herbarium, Dr. Fred B. Seaver of the New York Botanical Garden, and the curators of foreign herbaria from which in past years the writer has brought photographs of important specimens. The University of Michigan Press has kindly permitted the author to draw freely upon his handbook of North American Atlantic coast algae in preparing the descriptions of the algae secured on the Hancock Expedition.

The first set of specimens, including the technical types of the newly described species, will be deposited with the Hancock Foundation, a second set including portions of the type collections in the herbarium of the University of Michigan; duplicates will be distributed from these institutions.

## CHLOROPHYCEAE

### Ulvaceae

Plants membranous or tubular, of one or two layers of cells, in size moderate to large, and generally found in or near the littoral.

#### KEY TO GENERA

1. Plants tubular in section, the wall one cell layer thick . . . . . *Enteromorpha*
1. Plants membranous and expanded, the membrane two cell layers thick . . . . . *Ulva*

#### ENTEROMORPHA Link, 1820

##### KEY TO SPECIES

1. Simple or sparingly and subequally branched very close to the base, the branches moderately broad above; cell arrangement in the upper portion of the plant in part in longitudinal rows, but mostly somewhat irregular; cell shape rectangular to polyhedral, the lateral cell walls thick . . . . . *E. flexuosa*
1. Subsimple to generally freely slenderly branched, the branches lateral, progressively larger upward for 1-5 mm. above the base; cell arrangement in regular rows throughout; cell shape rectangular, lateral cell walls not conspicuously thickened . . . . . *E. lingulata*

These two species, the common ones of the American tropics, have in the past been distinguished as being broad and unbranched, or narrow and branched at the base. In attempting to fill out the incomplete species descriptions, the writer found discrepancies in the characters of specimens determined by careful workers, and so had to examine in detail a considerable number of collections. The revised descriptions which follow are, therefore, not based solely on the specimens cited. It was not found in all cases that all of the supposedly differentiating characters were in the combination appropriate to the species with which the specimen could best be identified. Some characters, particularly the occasional basal branching of *E. flexuosa*, are frequently misleading. When there is no clear preponderance of evidence, in individual cases it may be impossible to identify a collection; possibly these species are not as distinct as we have assumed them to be.



***Enteromorpha flexuosa* (Wulfen) J. Agardh**

Plants tufted, to 15 cm. tall, simple or sparingly divided at the base into similar segments; the solitary tube or all divisions slender and sub-solid at the base, gradually dilated upwardly, cylindrical above or becoming intestiniform, commonly to 5 mm., rarely to one centimeter or more in diameter; cells in longitudinal rows or, especially above, mostly rather irregularly disposed, about 10-28  $\mu$  wide, 8.5-28.0  $\mu$  long, rectangular to polyhedral, the lateral walls in surface view moderate to thick.

Collins 1909, p. 203.

A common tropical species in American waters, found near and just below low-tide level on sticks, coral fragments, shells, stones, etc.

NETHERLANDS WEST INDIES: Aruba Island, infrequent on the rocks on the inward side of the reef outside the cove at Punta Basora, no. 39-331, 10 April 1939. VENEZUELA: Cubagua Island, frequent on the shore ledges near the low-tide line, no. 39-446, 14 April 1939. BRITISH WEST INDIES: Tobago Island, infrequent on the rocks and reef, Buccoo Bay, no. 39-539, 20 April 1939.

***Enteromorpha lingulata* J. Agardh**

Plants tufted or turflike, to 7 cm., rarely to 15 cm. tall, rarely simple, more commonly sparingly to abundantly branched, the branches distributed along the lower part of the primary axis with the more developed ones higher than the filiform branch initials lower down; the divisions subsolid at the base, very slender and very gradually dilated upwardly, cylindrical above, generally not over 1.0-2.0 mm. diam., rarely a little broader; cells in very clear longitudinal rows, about 9-21  $\mu$  wide, 9-28  $\mu$  long, sharply rectangular, the lateral walls in surface view thin or very slightly thickened.

Probably as common on the coast of tropical America as the last. It forms a more continuous vegetation, with the plants more crowded and more slender. It also grows upon solid objects near the low-tide level, and was once dredged from deeper water.

VENEZUELA: Dredged off Cubagua Island at 3.5-9.0 meters on sandy bottom, no. 39-478, 14 April 1939. BRITISH WEST INDIES: Trinidad Island, on sticks and reeds floating in the little estuary of a stream behind the barrier beach, Manzanilla Beach, no. 39-490, 18-20 April 1939.

## ULVA Linnaeus, 1753

## KEY TO SPECIES

1. Thallus narrowly lobed in palmate or subpinnate fashion  
 . . . . . U. fasciata
1. Thallus broadly lobed to suborbicular . . . . . 2
2. Margins of the blade strikingly thinner than the center, the  
 central cells columnar and to three times as tall as broad,  
 while those of the margin are as broad as or broader than tall  
 . . . . . U. fasciata
2. Margins of the blade not notably thinner than the central  
 area, the cells not particularly different in shape . . U. Lactuca

*Ulva fasciata* Delile

Plants foliar membranous, from a minute stipe and disklike hap-  
 teron sharply expanded above to the blade, which may be irregularly  
 orbicular and broadly lobed, or more usually rather narrowly pinnately  
 to palmately lobed, the lobes to 10-30 cm. long and as narrow as 5-10  
 mm.; cells in the middle line of the lobes narrowly columnar, the blade  
 quite thick (to 135  $\mu$ ) and often, especially when dried, more glossy and  
 paler in color; but near the periphery the cells are nearly as broad as tall,  
 or even a little broader (to about 10-18  $\mu$  broad, 15  $\mu$  tall), the blade  
 darker green and thin (to about 30-45  $\mu$ ).

Vickers 1908, p. 15, pl. 2; Collins 1909, p. 216.

This is a very widely distributed tropical *Ulva* and one which is  
 immediately recognizable in the narrow form, though less so when  
 broadly lobed. Several forms have been described (Setchell in *Phycotheca*  
*Boreali-Americana* 809, 862, 863, and LXXVII; Howe 1914, p. 20).  
 There does not seem to be any possibility of segregating the Hancock  
 Expedition material, for the linear-lobed and the expanded forms appear  
 to intergrade in the same collections. The micrometer measurements of  
 frond thickness and cell size given here represent only a small sampling  
 of typical material.

NETHERLANDS WEST INDIES: Aruba Island, frequent on the inner  
 side of the seaward reef at Punta Basora, no. 39-329, 10 April 1939;  
 Curaçao Island, very abundant on the rocks near the pontoon bridge,  
 Willemstad, no. 39-563, 23 April 1939; Curaçao Island, abundant on  
 massive coral fragments along the shore, Jan Thiel Beach, no. 39-585,  
 23 April 1939. VENEZUELA: Tortuga Island, on scattered rocks along

the sandy shore, or drifting, Punta Arenas, no. 39-411, 13 April 1939; Cubagua Island, common on scattered rocks and ledges along shore, no. 39-444, 14 April 1939. BRITISH WEST INDIES: Tobago Island, very common on the coral rocks on the offshore reef, Buccoo Bay, no. 39-518, 20 April 1939; infrequent on the mainland beach, no. 39-526, 20 April 1939.

***Ulva Lactuca* Linnaeus, var. *rigida* (C. Agardh) Lejolis**

Collins 1909, p. 215; Taylor 1937, p. 75, pl. 4, figs. 6-8.

This *Ulva* is common in most parts of the world, on rocks and other solid objects in the lower intertidal belt, or slightly below low-tide line. In the tropics *U. fasciata* shares the suitable localities.

VENEZUELA: Cubagua Island, common on rocks and ledges along shore, no. 39-445, 14 April 1939.

## Chaetophoraceae

Filamentous plants, sometimes spreading and sometimes forming disks, usually microscopic or nearly so, the cells in some genera bearing long hairs.

### KEY TO GENERA

1. Filaments free, spreading in the host membrane . . . *Endoderma*
1. Filaments represented by radial cell series in the disciform plants . . . . . *Pringsheimia*

### ENDODERMA Lagerheim, 1883

#### *Endoderma vagans* Børgesen

Plants microscopic, endophytic in the membrane of the cells of the host plant, forming rather indefinite patches; filaments irregularly and widely branched, uniseriate, the cells 5-13  $\mu$  diam., 18-50  $\mu$  long, generally subcylindrical, sometimes uni- or bilaterally swollen, the swelling giving rise to a new branch, a small lateral cell, or not developing further; cells with a large chromatophore with several pyrenoids.

Børgesen 1920, p. 418, fig. 400.

Previously reported only from the Virgin Islands. This species seems rather close to *E. Wittrockii* (Wille) Lagerheim, but the cells appear to be more irregular and longer, the pyrenoids more numerous.

BRITISH WEST INDIES: Tobago Island, occasional in the cell wall of old specimens of *Bryopsis* washed ashore in Rockly Bay, no. 39-492, 19 April 1939.

### PRINGSHEIMIA Reinke, 1888

#### *Pringsheimia* Udoteae Børgesen (?)

Plant disciform, adnate by the lower surface, of one layer of cells produced by radiating branched closely approximated cell series, those cells near the center of the disk rather irregular, those near the periphery clearly seriate and growth marginal; cells in the older parts when fertile somewhat swollen on the upper surface and urn shaped, discharging zoospores by a definite pore; cells 5-25  $\mu$  diam., 17-70  $\mu$  long, commonly about 16  $\mu$  diam. and 40  $\mu$  long.

Børgesen 1913, p. 11, fig. 3.

This plant has previously been reported only from the Virgin Islands. Its habitat in our collection differs, for in the type material it appeared on the flabellum of *Udotea*.

BRITISH WEST INDIES: Tobago Island, on shells along shore, Buccoo Bay, no. 39-556, 20 April 1939.

## Valoniaceae

Plants with large, coenocytic cells in which, in the multicellular genera, septation is often long delayed after the development of the branching portion of the parent cell; when filamentous, the branches often are joined to form plane nets; when parenchymatous, forming rather massive plants.

### KEY TO GENERA

1. Plants of one to few vegetative cells, which are of very large size . . . . . *Valonia*
1. Plants of smaller cells . . . . . 2
2. Plants not netlike . . . . . 3
2. Plants netlike . . . . . 5
3. Plants clearly parenchymatous, the small coenocytes forming a single wall layer, the plant generally hollow when mature, attached by rhizoidal cells on the under side, finally torn into irregular lobes . . . . . *Dictyosphaeria*
3. Plants filamentous, or appearing so . . . . . 4



4. Plants with an elongate axis cell which after division bears long branch cells . . . . . *Siphonocladus*
4. Plants growing continuously from the upper parts of the branches, which though with delayed septation become uniseriate, multicellular; with the aspect of a *Cladophora* . . . . . *Cladophoropsis*
5. Plants sessile, netlike throughout, showing polychotomously divided "veins" . . . . . *Anadyomene*
5. Plants stipitate, netlike above, with a definite, naked stalk and a midrib which bears lateral "veins" . . . . . *Struvea*

### VALONIA Ginnani, 1757

#### KEY TO SPECIES

1. Plants large, of single assimilatory coenocytes without visible divisions or branching, attached by minute hapteron cells . . . . . *V. ventricosa*
1. Plants of smaller or more slender cells, clearly subdivided . 2
2. Plants large, matted or tufted, the larger clavate cells not forming a continuous crust . . . . . *V. utricularis*
2. Plants small, forming crustose aggregations, the surface individuals closely crowded and often divided to numerous small cells . . . . . *V. ocellata*

#### *Valonia ventricosa* J. Agardh

Plants solitary or rarely a very few together, each consisting of a single large coenocyte with a group of minute, nearly microscopic, hold-fast cells near the lower end; dark and dull green, the wall often iridescent; spherical or more usually obovate, commonly 1-3 cm. diam., and to as much as 5 cm. diam., 7 cm. long.

Vickers 1908, p. 21, pl. 23a; Collins 1909, p. 373; Taylor 1928, p. 75, pl. 13, fig. 18.

A plant frequently occurring throughout the Caribbean area, though not often in abundance. It has been reported from Bermuda to Brazil. It is generally found in relatively shallow water or even in intertidal pools attached in crevices or under rocks, or among matted algae, and never completely exposed to the light.

PANAMA: Caledonia Bay, infrequent, on the rhizomes of *Thalassia* and on broken corals in shallow water near Isla Piedra and I. San August-

tin, no. 39-178, 3 April 1939. NETHERLANDS WEST INDIES: Aruba Island, infrequent under coral rocks in shallow water near the shore of the cove at Punta Basora, no. 39-321, 10 April 1939; rare as dredged in 43 meters from a bottom of sand and coralline algae near Aruba Island, sta. A18, no. 39-361b, 10 April 1939; Curaçao Island, a single specimen found among collections in shallow water along the shore, Jan Thiel Beach, no. 39-586, 23 April 1939. BRITISH WEST INDIES: Tobago Island, common, growing nearly hidden among the upper branches of colonies of *Halimeda Opuntia* in the intertidal zone on Buccoo Reef, no. 39-515, 20 April 1939.

### *Valonia utricularis* (Roth) C. Agardh

Plants forming rounded masses to 5 cm. thick, composed of stout cylindrical branched cells which are 1.0-2.5 mm. diam. and 5-20 mm. long, more or less prostrate and entangled below, erect above and clavate-cylindrical to arcuate, branching from the sides or ends.

Collins 1909, p. 373, pl. 15, fig. 138; Taylor 1928, p. 75, pl. 13, fig. 19.

Not a frequently reported plant, but in the Caribbean area listed from Bermuda to Brazil, where it is found in relatively shallow water.

BRITISH WEST INDIES: Trinidad Island, where a single plant was dredged at 3-5 meters at sta. A35, no. 39-489b, 18 April 1939.

### *Valonia ocellata* Howe

Plants aggregated into crusts about 1 cm. thick, occasionally to 6 cm.; loosely associated below and attached by coarse rhizoidal extensions 0.5-0.8 mm. diam., 5-30 mm. long; more closely crowded above and in part mutually compressed; cells at the surface 2-4 mm. diam., simple or dividing to form small and crowded columnar to rounded cell masses with individual cells 0.3-0.6 mm. diam.

Howe 1920, p. 603; Taylor 1928, p. 75, pl. 13, fig. 20.

A common reef plant in the Caribbean area, known from Bermuda to the Virgin Islands. It is found on broken corals and rocks, especially in crevices, in the intertidal zone.

NETHERLANDS WEST INDIES: Aruba Island, very common on old, dead coral masses along the shore of the cove at Punta Basora, no. 39-343, 10 April 1939.

**DICTYOSPHERA** Decaisne, 1892**Dictyosphaeria cavernosa** (Forsskål) Børgesen

Plants subspherical to hemispherical or even more expanded, to 3-9 cm. diam., light green in color and the surface often iridescent; adherent by rhizoidal holdfast cells chiefly from a central basal area; simple, sparingly laterally proliferated or a few laterally uniting; at first solid or nearly so, soon becoming hollow with the cells in a firm peripheral layer; or the sac split open and explanate; coenocytic cells large, turgid and outwardly swollen, commonly 0.1-1.5 mm. diam., laterally united by close-placed microscopic tenacular projections.

Harvey 1858, p. 50, pl. 44, figs. B1-3; Vickers 1908, p. 21, pl. 22; Børgesen 1932, p. 2; Taylor 1928, p. 72, pl. 5, figs. 10, 25, pl. 11, fig. 15 (all as *D. favulosa*).

This is a very common plant of the whole Caribbean area, and with its congeners is generally distributed through the tropics. It is chiefly found on rocks in shallow water, and in rock crevices or tide pools, but frequently is exposed with the receding tide. In crevices it frequently forms long lines of minute, ill-developed thalli which do not grow sufficiently to appear hollow.

PANAMA: Caledonia Harbor, occasional on the rocks in shallow water along the shore near Isla Piedra and I. San Augustin, *no.* 39-192, 3 April 1939. NETHERLANDS WEST INDIES: Aruba Island, infrequent on rocks along the shore of the cove at Punta Basora, *no.* 39-314, 10 April 1939.

**CLADOPHOROPSIS** Børgesen, 1905**Cladophoropsis membranacea** (C. Agardh) Børgesen

Plant pale green, forming tufts or dense mats on rocks and corals, to 5 cm., rarely to 10 cm. high; filaments attached by lobed disciform haptera, often borne on adjacent short cells to form an extensive attaching organ; erect filaments 170-270  $\mu$  diam. below, alternately branched, without a distinct main axis; above more closely and unilaterally branched, the branchlets issuing at the summit of the supporting cell without producing a cross wall at the base of the branchlet until it is well developed, and often not until it has divided across much higher up; branchlets 100-145  $\mu$  diam., commonly curved.

Vickers 1908, p. 20, pl. 17; Collins 1909, p. 362; Børgesen 1913, p. 47, figs. 26-33; Taylor 1928, p. 65, pl. 4, fig. 14.

This very common and widely spread tropical marine alga is found on rocks and in crevices, particularly in intertidal pools and near low-tide line. It has been reported from Bermuda to Brazil.

NETHERLANDS WEST INDIES: Aruba Island, forming dense mats on the higher intertidal rocks along the shore of the cove at Punta Basora, no. 39-312b, 10 April 1939; Curaçao Island, abundant in rock crevices above low-tide line, Jan Thiel Beach, no. 39-584, 23 April 1939.

### ANADYOMENE Lamouroux, 1816

#### *Anadyomene stellata* (Wulfen) J. Agardh

Plate 5, Fig. 1

Plants of clustered foliaceous expanded lobed segments, to 5 cm. tall and 8 cm. broad, probably more in extreme cases, basally attached by rhizoidal haptera; structurally composed of large, easily visible (to 3-7 mm. long), polychotomously arranged rib cells producing "veins," from which closely placed lateral cells arise in complanate fashion, these and their branches joining along the faces in contact to complete the essentially monostromatic blade.

Harvey 1858, p. 49, pl. 44, figs. A1-3 (as *A. flabellata*); Vickers 1908, p. 21, pl. 21; Collins 1909, p. 365, pl. 14, fig. 125; Taylor 1928, p. 70, pl. 5, fig. 12, pl. 6, fig. 3.

A widely distributed tropical plant, commonly quite small (about 1 cm. tall), and densely crowded, but protected individuals becoming much better developed; it is particularly frequent in rock crevices in shallow water or tide pools, but also may appear on broken corals or rocks dredged from considerable depths.

PANAMA: Caledonia Harbor, where abundant in rock crevices in shallow water near Isla Piedra and I. San Augustin, no. 39-173, 3 April 1939.

### SIPHONOCCLADUS Schmitz, 1878

#### *Siphonocladus tropicus* (Crouan) J. Agardh

Plants small, to about 4 cm. tall, consisting of a primary coenocyte which is cylindric to clavate with annulations near the base, and which becomes subdivided in the upper part to a parenchyma the cells of which develop laterally to produce numerous clavate branches which exceed the primary cell and which may in turn divide.

Howe 1905a, p. 245, pl. 13, fig. 2; Vickers 1908, p. 20, pl. 18; Collins 1909, p. 374.

Reported from Bermuda to Tobago Island, this plant is not common.

VENEZUELA: Tortuga Island, rare as cast ashore near Punta Arenas, no. 39-365, 13 April 1939.

### STRUVEA Sonder, 1845

#### *Struvea ramosa* Dickie

Plate 5, Fig. 2

Plant to 10 cm. tall, stipitate below, the stalk 1-3 cm. long, 1.0-1.25 mm. diam., of 1-3 cells, the lower cell 1-3 cm. long, slightly contracted below and simple or occasionally forked once or twice; above the ramification forming a flat blade, to 7 cm. long and 5 cm. wide; hapteron more or less lobed and penetrating; blades irregular, netlike. The chief axes from the haptera persist as midribs of the blades. From these opposite lateral axes arise in pairs. The lower of these may support subsidiary lateral blades, but the upper ones form lateral ribs ("veins") of the large primary blade. On these lateral ribs tertiary ones arise, 2-4 at a node, and these redivide more irregularly, the subdivisions uniting to produce the netlike blade; ultimate meshes about 0.25-1.00 mm. diam.

Murray and Boodle 1888, pp. 269, 280, pl. 16, fig. 3; Collins 1909, p. 377.

Previously reported from Bermuda and the Canary Islands only; a rare alga. The material available to Murray and Boodle was extremely limited. It seems to correspond to the smaller, branched specimens of the present series. While Murray and Boodle appear to assume that the forked stipe and small blades were fixed characters of the species, the writer considers that, when able to develop fully, a large main blade may grow to the exclusion of any subsidiaries. *S. elegans* Børg. (Børgesen 1913, p. 51, figs. 37, 38; Taylor 1928, p. 74, pl. 6, figs. 6, 7) is obviously different in the more branched main axis, the great length acquired by the ramifications of the lateral axes ("veins") before they form cross walls or subdivide, and by the far larger meshes, which reach a diameter of some millimeters. From *S. anastomosans* (Harvey) Piccone (Børgesen 1913, p. 54, fig. 39; Taylor 1928, p. 73, pl. 3, fig. 10) it differs in far larger size, in having its blades free rather than concrescent, and in the frequent appearance of more than one pair of branch cells at a node.

NETHERLANDS WEST INDIES: Dredged from 43 meters' depth off a bottom of sand and coralline algae at sta. A18 near Aruba Island, no. 39-356, 10 April 1939.



## Cladophoraceae

Plants filamentous, the filaments simple or branched, the branches free, uniseriate, the cells with few to several nuclei.

### KEY TO GENERA

1. Plants unbranched . . . . . Chaetomorpha
1. Plants rarely branched, branches rhizoidal, cells somewhat irregular in contour or arrangement . . . . . Rhizoclonium
1. Plants freely branched, the branches like the axis . . . Cladophora

### CHAETOMORPHA Kützinger, 1845

Plants filamentous, the filaments uniseriate, branching absent, the regularly cylindrical cells with numerous peripherally placed nuclei and a much-dissected chromatophore with many pyrenoids; the plants attached by a basal cell, which may be well marked in form, or growing unattached and with no evidence of holdfasts.

### KEY TO SPECIES

1. Plants definitely attached, and forming erect tufts . . . *C. media*
1. Plants entangled, without definite point of attachment . . . 2
2. Filaments generally less than 180  $\mu$  diam., and the cells generally shorter than broad . . . . . *C. brachygona*
2. Filaments generally over 200  $\mu$  diam., and the cells generally longer than broad . . . . . *C. Linum*

### *Chaetomorpha media* (C. Agardh) Kützinger

Plants attached, gregarious, the filaments rather stiff and erect, to 17 cm. tall; hapteron consisting of several branched, almost rhizoidal extensions of the basal cell; basal cell notably distinct, somewhat clavate, to 4-7 mm. long, to 360-465  $\mu$  diam.; lower cells of the axis about 360  $\mu$  diam., 3-4 diameters long, slightly cask shaped; cells in the middle part of the axis about 230-350  $\mu$  diam., about 1.5 diameters long, cylindrical; cells in the upper part of the axis, especially if fruiting, 360-460  $\mu$  diam., 0.75-1.5 diameters long, markedly cask shaped.

Vickers 1908, p. 17, pl. 8, as *C. antennina*.

The present species appears to be a fairly common alga in this part of the Caribbean. It is intertidal, growing on rocks, especially in crevices, and often where exposed by low tide. The tufts are usually quite dense

and firm, the color pale yellowish where exposed above, darker below. It corresponds to *C. antennina* of the west coast, which becomes larger and has an even more obvious basal cell. Somewhat similar in habit and also found in the Caribbean is *C. clavata* (C. Ag.) Kützinger, which has a small basal cell attaching by a lobed disk.

PANAMA: Caledonia Bay, occasional to frequent on rocks in the lower intertidal and upper littoral zones, along the shore near Isla Piedra and I. San Augustin, nos. 39-185, 39-240, 3, 4 April 1939. NETHERLANDS WEST INDIES: Aruba Island, frequent on the higher intertidal rocks along the shores of the cove at Punta Basora, no. 39-306, 10 April 1939; Curaçao Island, occasional on the rocks along the shore, Jan Thiel Beach, no. 39-593, 23 April 1939. VENEZUELA: Tortuga Island, frequent on the coastal rocks, and larger plants occasionally washed ashore on the western end of the island, nos. 39-362, 39-408b, 13 April 1939.

### ***Chaetomorpha brachygona* Harvey**

Taylor 1928, p. 60, pl. 4, fig. 12.

This is rather a common tropical alga, and for the most part replaces *C. Linum*, more familiar in the north. There is some overlapping in the extreme measurements for these two species, but there is seldom difficulty in separating the coarser and more wiry *C. Linum* from the softer, more slender, typically tropical species.

PANAMA: Caledonia Harbor, common near the water's edge along the shores near Isla Piedra and I. San Augustin, entangled among other algae, no. 39-184, 3 April 1939. NETHERLANDS WEST INDIES: Aruba Island, infrequent among other algae along shore, Punta Basora, no. 39-313, 10 April 1939.

### ***Chaetomorpha Linum* (Müller) Kützinger**

Taylor 1928, p. 60, pl. 4, fig. 11; 1937, p. 80, pl. 1, figs. 1, 2.

PANAMA: Caledonia Harbor, scantily represented, entangled among other algae on rocks and ledges along the shores near Isla Piedra and I. San Augustin, no. 39-183, 3 April 1939.

### **RHIZOCLONIUM Kützinger, 1843**

Plants filamentous, the filaments uniseriate, the cells with few to several nuclei and much-dissected chromatophores with small pyrenoids; branching absent, or if present the branches short and rhizoidal, or rudimentary, of few cells.

It is by no means easy to distinguish members of this genus from *Chaetomorpha* when they are ill developed, particularly when, as usual, branches are absent. However, there is in addition to size a characteristic aspect produced by the somewhat irregular outline of the cells and the fact that they are often not exactly aligned in the filament, which facilitates recognition of the genus.

#### KEY TO SPECIES

1. Branching absent, cells 10-14  $\mu$  diam., 3-7 diameters long .  
 . . . . . R. Kerner
1. Branching present or absent, when present of one to a few  
 cells; cells in the filaments 15-30  $\mu$  diam., 1-2 diameters long  
 . . . . . R. riparium

#### *Rhizoclonium Kerner* Stockmayer

Collins 1909, p. 329; Børgesen 1920, p. 427, fig. 407.

NETHERLANDS WEST INDIES: Curaçao Island, in small masses along the beach, Valentijn's Bai, Willemstad, coll. F. H. Elmore, *no.* 39-573, 23 April 1939.

#### *Rhizoclonium riparium* (Roth) Harvey, *prox.*?

Collins 1909, p. 327.

This species is widespread, in some form or other, in subarctic, temperate, and tropical waters. The present specimen differs from the usual concept in that its filaments are little flexuous, lack branches, and show little irregularity in the form of the cells, which are clearly contracted at the septa. The diameter of the filaments varies from 26-28  $\mu$ , and the cell length to 95-170  $\mu$ , averaging about 5 diameters. This is longer than is characteristic of the species.

BRITISH WEST INDIES: Tobago Island, entangled among other algae, particularly *Hypnea*, in small quantity, Buccoo Bay, *no.* 39-525, 20 April 1939.

#### CLADOPHORA Kützinger, 1843

Plant bushy, freely alternately or oppositely branched, multicellular, the arrangement uniseriate, the cells multinucleate, with little difference between axial and branch cells; growth apical.

About 80 species and several varieties of *Cladophora* have been reported from the eastern American tropical seas, of which less than half

are clearly understood. It would be expected from this that these plants would appear at nearly every station. On the contrary, though there are a few collections from the present expedition which were not readily identified and remain unreported, on the whole members of the genus were seldom found.

### KEY TO SPECIES

1. Plants dull green, closely tufted, the main filaments to 350  $\mu$  diam. or more, bearing more or less second series of short, stout branchlets . . . . . *C. fuliginosa*
1. Plants bright green, larger, and softer . . . . . 2
2. To 10 cm. tall, loosely virgately branched, the axes 40-60  $\mu$  diam. below; branchlets 20-30  $\mu$  diam. above, and in short second series . . . . . *C. delicatula*
2. To 50 cm. tall, sparingly branched below and axes to 200-250  $\mu$  diam.; more freely branched above; branchlets fasciculately clustered, 80-120  $\mu$  diam. . . . . *C. fascicularis*

### *Cladophora delicatula* Montagne

Collins 1909, p. 337; Taylor 1928, p. 61.

Reported from several stations, Bermuda to the Guianas, though not by numerous collectors.

VENEZUELA: Cubagua Island, very common on the intertidal rocks scattered over a sandy beach, no. 39-447, 14 April 1939.

### *Cladophora fascicularis* (Mertens) Kützing

Vickers 1908, p. 18, pl. 13; Collins 1909, p. 345; Taylor 1928, p. 62.

The most frequently reported *Cladophora* of the American tropics, this plant ranges from North Carolina and Bermuda through the West Indies to Uruguay.

COLOMBIA: Dredged off Cape LaVela, attached to Sargassum which came up with the anchor from 9 meters' depth at sta. A12a, no. 39-274, 8 April 1939. VENEZUELA: Tortuga Island, infrequent among algae washed ashore on the beach at Punta Arenas, no. 39-419, 13 April 1939; Cubagua Island, abundant and large plants attached to ledges and scattered rocks near low-tide line, no. 39-443, 14 April 1939.

### *Cladophora fuliginosa* Kützing

Harvey 1858, p. 48, pl. 45, figs. C1-2 (as *Blodgettia confervoides*); Collins 1909, p. 348; Taylor 1928, p. 62, pl. 4, fig. 5.

Frequently reported from numerous stations in the Caribbean area, and ranging from Bermuda to British Honduras and Guadeloupe.

NETHERLANDS WEST INDIES: Forming dense mats on the higher intertidal rocks along the shore of the cove at Punta Basora, *no. 39-315*, 10 April 1939.

## Dasycladaceae

Plants noted for the regular whorls of branchlets on the simple unicellular, or sparingly branched axis, the character of these branchlets determining the aspect of the plant. There are several tropical genera, but only one to be reported from the present expedition.

### NEOMERIS D'Archiac, 1843

Plants small, 1-2 cm. tall, solitary or gregarious on shells, corals, or stones, shortly stipitate, cylindrical with somewhat tapered ends, the top showing a crown of bright green filaments, but most of the plant encased in a calcareous crust; structurally showing an axis with whorls of once-forked filaments, the tips of the secondary branch cells swollen and constituting the cortex.

#### KEY TO SPECIES

1. Sporangia strongly calcified, by this incrustation laterally coherent into more or less complete rings . . . . . *N. annulata*
1. Sporangia while strongly calcified laterally free, not forming rings . . . . . *N. mucosa*

#### *Neomeris annulata* Dickie

Howe 1909, p. 87, pl. 1, fig. 2; Collins 1909, p. 382; Børgesen 1913, p. 71, figs. 55-57; Taylor 1928, p. 70, pl. 5, figs. 5, 14.

A widely distributed tropical alga chiefly found in shallow water on shells, corals, and stones, within our area ranging from Bermuda to Barbados.

PANAMA: Caledonia Harbor, scarce, on fragments of corals, etc., along the shore near Isla Piedra and I. San Augustin, *no. 39-174*, 3 April 1939, and *no. 39-247*, 4 April 1939.

#### *Neomeris mucosa* Howe

Howe 1909, p. 84, pl. 1, fig. 5, pl. 5, figs. 1-14; Collins 1909, p. 381.



Previously known only from the Bahamas and Cuba, the extension of records of this species to Curaçao is of considerable interest; however, as the species in this genus require close scrutiny to determine the differences, it is very possible that it will eventually appear widespread in the Caribbean. The habitat appears to be the same as for *N. annulata*.

NETHERLANDS WEST INDIES: Curaçao Island, rare on massive broken corals along shore, Jan Thiel Beach, no. 39-599, 23 April 1939.

## Bryopsidaceae

Plants tufted, coenocytic, the axial coenocytes bearing radial or pinnate lateral branchlets which are not entirely cut off from the axis, and which in mature plants may act as gametangia.

### BRYOPSIS Lamouroux, 1809

#### *Bryopsis pennata* Lamouroux

Plants tufted, to 5-7 cm. tall; dark green; basal attachment by rhizoidal outgrowths from the lower part of the axis; axes below crowded, somewhat branched and entangled, above free and erect, seldom branched; in the upper portion closely beset with distichous determinate ramuli 2-5 mm. long, forming a rather long and narrow blade.

Harvey 1858, p. 31, pl. 45, figs. A1-3 (as *B. plumosa* vars.); Vickers 1908, p. 30, pl. 53; Taylor 1928, p. 93, pl. 11, fig. 13.

Ordinarily a rather common tropical tide-pool alga with wide American distribution from Bermuda to Brazil, but not frequently found during this expedition.

COLOMBIA: Dredged on some Sargassum brought up on the anchor chain about 18 miles off Cape LaVela, no. 39-288, 8 April 1939; poorly developed and the determination somewhat uncertain. NETHERLANDS WEST INDIES: Aruba Island, frequent and forming large tufts on the worn coralline rocks of the shore of the cove at Punta Basora, no. 39-323, 10 April 1939.

## Caulerpaceae

Plants coenocytic, the coenocytes commonly becoming of great size, but branching in forms simulating the rhizoids or roots, stems, and leafy branchlets of higher plants.

**CAULERPA** Lamouroux, 1809

Moderate to sometimes very large plants, showing a widely spreading rhizomatous base with descending colorless rootlike anchorage branches and erect green assimilatory branches which are simple and phylloid, or exhibit an axis bearing distichous or pluriseriate ramuli of various shapes; plants coenocytic, with trabeculae from the wall traversing the cavity, the axis and branches not twisted about each other to give rise to a massive structure.

**KEY TO SPECIES**

1. Assimilatory branches flat, undivided, more or less lanceolate  
 . . . . . *C. prolifera*
1. Assimilatory branches toothed, forked, lobed, or otherwise  
 divided into ramuli . . . . . 2
2. Axis and ramuli cylindrical . . . . . 3
2. Axis and mucronate ramuli flattened, distichous . . . 5
3. Ramuli mucronate . . . . . 4
3. Ramuli smooth on the rounded ends . . . . . *C. racemosa*  
     Ramuli moderately large and spherical on the end, fairly  
     sharply distinct from the longer stalk portion; larger,  
     and plants of shallow water . . . . . var. *clavifera*  
     Ramuli spherical, very small, very sharply distinct from  
     the short cylindrical stalk; plants of deep water . .  
     . . . . . var. *microphysa*  
     Ramuli long-clavate to subcylindrical, on a long axis,  
     erect spreading; plants of quiet tide pools . var. *laetevirens*  
     Ramuli short, broader, and somewhat flattened on the ex-  
     posed face, crowded on a short axis; plants of exposed  
     reef faces . . . . . var. *uvifera*
4. Ramuli subconical to cylindrical, short and divergent . .  
     . . . . . *C. cupressoides*  
     Ramuli subcylindrical, about six times as long as the axis  
     . . . . . var. *Lycopodium*  
     Ramuli subnavicular, in length not more than twice the  
     diameter of the axis . . . . . var. *mamillosa*
4. Ramuli cylindrical, 10 diameters long or more . *C. sertularioides*  
     Erect axes generally simple, ramuli pluriseriate, erect,  
     crowded . . . . . f. *Farlowii*  
     Erect axes generally simple, ramuli distichous, extending  
     to the bases of the erect axes . . . . . f. *brevipes*

Erect axes generally freely branched, ramuli distichous,  
sometimes not present on the lower part of the erect

- axes . . . . . f. *corymbosa*  
 5. Ramuli straight, linear, compressed . . . . . *C. taxifolia*  
 5. Ramuli upcurved, broader, and quite flat . . . . . *C. crassifolia*  
     Ramuli well separated . . . . . f. *typica*  
     Ramuli overlapping at the tips, often wider near the distal  
     end . . . . . f. *mexicana*

***Caulerpa prolifera* (Forsskål) Lamouroux**

Harvey 1858, p. 16, pl. 38, fig. B1; Weber-van Bosse 1898, p. 278, pl. 22, fig. 1; Collins 1909, p. 413, pl. 18, fig. 160; Børgesen 1913, p. 127; Taylor 1928, p. 100, pl. 12, fig. 15.

This is a very widespread member of the genus which in the Caribbean area is more often found in water of moderate to considerable depth than in the littoral. It ranges from North Carolina to Brazil.

COLOMBIA: Dredged in abundance from a bottom of gray sand at 24 meters, sta. A13 off Cape LaVela, no. 39-256, 8 April 1939; dredged from a bottom chiefly of coralline algae at 16-18 meters, sta. A15 off Bahia Honda, no. 39-283, 8 April 1939; dredged in abundance from a sandy bottom at 22 meters' depth, sta. A48 off Galera Point Light, no. 39-616, 25 April 1939. VENEZUELA: Tortuga Island, fragments washed ashore on the beach, Punta Arenas, no. 39-374, 13 April 1939; dredged in abundance from a bottom of coral sand and algae at 3.5-9.0 meters' depth, sta. A22 near Tortuga Island, no. 39-423, 13 April 1939.

***Caulerpa crassifolia* (C. Agardh) J. Agardh**

Harvey 1858, p. 16, pl. 37, figs. A1, 2 (as *C. mexicana*); Weber-van Bosse 1898, p. 289, pl. 24, figs. 1-4 (as *C. pinnata*); Vickers 1908, p. 26, pl. 60 (f. *mexicana*); Collins 1909, p. 413; Børgesen 1913, p. 130, figs. 102, 103; Taylor 1928, p. 96, pl. 12, figs. 10, 21.

A plant widespread in the Caribbean region, where it is found in water of moderate to considerable depth, attached to shells and coral fragments scattered on a sandy bottom.

**f. *typica* (Weber-van Bosse) Børgesen**

COLOMBIA: Dredged at 24 meters from a bottom of gray sand, sta. A13 off Cape LaVela, no. 39-257a, 8 April 1939. VENEZUELA: Tortuga Island, rare fragments washed ashore, no. 39-375, 13 April 1939.

**f. mexicana** (Sonder) J. Agardh

COLOMBIA: Dredged at 24 meters from a bottom of gray sand, sta. A13 off Cape LaVela, *no. 39-257b*, 8 April 1939; dredged at 16-18 meters' depth from a bottom of coralline algae at sta. A15 off Bahia Honda, *no. 39-284*, 8 April 1939. VENEZUELA: Dredged at 3.5-9.0 meters from a bottom of coral sand and algae at sta. A22 off Tortuga Island, *no. 39-422*, 13 April 1939.

**Caulerpa taxifolia** (Vahl) C. Agardh

Weber-van Bosse 1898, p. 292; Vickers 1908, p. 26, pl. 41; Collins 1907, p. 414; Børgesen 1913, p. 132, figs. 104, 105.

A rather less common plant than the other *Caulerpa*s listed in this paper, but ranging from Bermuda to British Honduras and Barbados in our area.

NETHERLANDS WEST INDIES: Curaçao, abundant along the rocky shore of Valentijn's Bai, Willemstad, coll. F. H. Elmore, *no. 39-575*, 23 April 1939.

**Caulerpa sertularioides** (Gmelin) Howe

Harvey 1858, p. 17, pl. 38, figs. C1-2; Weber-van Bosse 1898, p. 294, pl. 24, figs. 4-6 (both as *C. Plumaris*); Vickers 1908, p. 26, pl. 42; Collins 1909, p. 414; Børgesen 1913, p. 133, fig. 106, 1932, p. 7; Taylor 1928, p. 103, pl. 12, figs. 2, 17, pl. 13, fig. 5.

A common Caribbean species of *Caulerpa*, which ranges from Bermuda to Brazil. It is generally a plant of quite shallow water, but occasionally is dredged from considerable depths. On rocks exposed at ebb tide or beaten by surf the *f. brevipes* is common; in warm, deep, and protected tide pools, *f. longiseta*.

**f. brevipes** (J. Agardh) Svedelius

PANAMA: Caledonia Bay: infrequent along shore near Isla Piedra and I. San Augustin, *no. 39-181*, 3 April 1939, *no. 39-233*, 4 April 1939. NETHERLANDS WEST INDIES: Curaçao Island, apparently rare, approaching this form, along the rocky shore of Valentijn's Bai, Willemstad, collected by F. H. Elmore, *no. 39-576*, 23 April 1939. VENEZUELA: Tortuga Island, infrequent fragments picked up on the shore, Punta Arenas, *no. 39-376*, 13 April 1939; Cubagua Island, frequent on ledges and scattered coral rocks, *no. 39-448*, 14 April 1939. BRITISH WEST INDIES: Tobago Island, frequent along the shore of Buccoo Bay, *no. 39-509*, 20 April 1939.

**f. Farlowi** (Weber-van Bosse) Børgesen

Plate 6, Fig. 2

NETHERLANDS WEST INDIES: Aruba Island, common, scattered patches in very shallow water among the rocks along the shore of the cove at Punta Basora, no. 39-326, 10 April 1939.

**f. corymbosa** n. f.<sup>1</sup>

Plate 6, Fig. 1

Plants 2-8 cm. tall, abundantly branched from a creeping rhizome, the erect branches sometimes bearing ramuli to the base, sometimes naked for the lower 5-15 mm. Erect axes abundantly and rather densely subcorymbosely branched, particularly in the upper portion, usually to one degree, but frequently rebranched to the second, and even occasionally the third degree, the branching alternate or vaguely dichotomous, producing to 10-20 or more branches upon a single erect base. Ramuli rather close, about 15 per cm. below, to 22 per cm. near the tips, rather short, about 7 mm. long on the lower portions of strong shoots, to 3 mm. on upper branches, rather slender and slightly upcurved.

NETHERLANDS WEST INDIES: Curaçao Island, growing among broken coral rocks along shore, Jan Thiel Beach, no. 39-587, 23 April 1939; abundant over the muddy bottom of a concrete pool, Jan Thiel Beach, no. 39-582, 23 April 1939.

The rather dense, somewhat corymbose branching of these specimens made them striking objects in the field, both in the dwarfed or ill-developed ones from the hot stagnant water of what appeared to be a disused bathing pool and in the more normal specimens from the open shore.

If one examines Collins' treatment of *Caulerpa*, one finds that his description at once leads to *C. sertularioides* f. *longipes* (C. Agardh) Collins as the name for the Curaçao plants (Collins 1909, p. 415). However, they do not at all resemble what the present author called by this name in his report on the Florida marine algae (1928, p. 103). These Florida plants were much taller, with fronds to 18 cm. tall or more, of which the basal 1.0-3.5 cm. were naked. The fronds commonly had 1-3 branches; the slender pinnules were 12-14 per cm. on the axis, and very evenly 10-13 mm. long. While normally biseriate, triseriate specimens were seen as an abnormality.

<sup>1</sup> *Caulerpa sertularioides* f. *corymbosa*—Planta ramis erectis e rhizomate orientibus praedita; ramis in basi nudis aut ramuliferis, supra alterne aut subdichotome furcatis, interdum ternatim, aspectu dense subcorymbosis, 10-20 aut plures divisiones habentibus; aliter, velut in specie. Planta typica in loco dicto Jan Thiel Beach, Curaçao Island, Netherlands West Indies, no. 39-587, 23 April 1939.



If one now refers back to the source of the name (Weber-van Bosse 1898, p. 295, as *C. plumaris* f. *longipes* [J. Ag.] Weber-van Bosse; J. Agardh 1872, p. 15; Turner 1808, pl. 54, as *Fucus taxifolius* Turner non Vahl), we find illustrated a plant different from either the Curaçao or the Florida specimens. Turner's illustration is no doubt a faithful record of the plant he had. His description follows Vahl's account of *F. taxifolius*, not the illustration, which it does not fit, and presumably not the specimen. The plant illustrated showed scattered erect axes sparingly distributed over the rhizomatous base. They were of irregular length, more or less naked below and occasionally branched. Neither the extent of naked axis nor the amount of branching is notable for the species. Most characteristic are the general sprawling habit and the irregular length of the pinnules, which are on the whole exceptionally short. The plant came from western India; it does not resemble the West Indian and Florida ones in spite of their fitting the description.

If now one considers the f. *longiseta* (Bory) Svedelius (*perperam* *C. sertularioides* f. *longiseta* [J. Agardh] Svedelius) for the Florida plants, one finds there also a somewhat troublesome situation. Collins described it as having "Pinnules fine, long (2 cm.) and close together," but if we trace back the chief literature on the form we find that this description is not very satisfactory, nor the nomenclatorial accuracy all that could be desired (Børgesen 1913, p. 133; Collins 1907, p. 415; Svedelius 1906, p. 114, fig. 10; Weber-van Bosse 1898, p. 295; J. Agardh 1872, p. 15; Bory de St. Vincent 1826-29, p. 194, pl. 22, fig. 4 as *C. Plumaris* var.  $\beta$  *Longiseta*). The origin of the name clearly rests with Bory, rather than with J. Agardh; his description is as follows: "Varietas  $\beta$ , Longiseta, pinnis elongatis gracilibus. N. Pl. 22, fig. 4 . . . mais elle en est une variété remarquable à frondes plus molles, et paraissant bien plus larges par l'effet des pinnules opposées, qui sont très-fines, longues de deux à trois lignes, et même de quatre. Ses frondes sont presque toutes simples, s'élèvent solitaires d'une tige peu rameuse, traçante, noirâtre et qui n'est guère plus grosse qu'une chanterelle de violon. Elles sont presque sessiles ou très-brièvement pédonculées; leur longueur, qui d'ordinaire n'excède guère deux pouces, atteint cependant à trois et demi sur quelques individus." This fits our Florida material somewhat better. The ramuli (pinnules) are long; the French *ligne* having a value of  $0.225 +$  cm. would give a length of a little over 9 mm., well within the range of the Floridian and West Indian material. His figures show branched and simple fronds, but they are very much shorter than those from America.

If now we compare Svedelius' illustrations, we find shorter-fronded plants again. On the whole, then, the Floridian specimens in question represent a considerable extension of the line of variation which Bory intended to designate; his form name may be used, pending a decision that they are sufficiently distinct to justify a new one.

Reconsideration of the numerous specimens of *G. sertularioides* available, representing the territory between Bermuda, Brazil, and the Central American mainland as well as a considerable number from both eastern and western Pacific waters, has emphasized the degree to which these forms intergrade. The names, as form names, are very helpful, because they are rather well associated with definite ecological habitats; there is no indication that the characters are stable.

***Caulerpa cupressoides* (Vahl) C. Agardh**

Harvey 1858, p. 21, pl. 39; Weber-van Bosse 1898, p. 323, pls. 27, 28; Vickers 1908, p. 27, pl. 43, var. *Lycopodium*; Collins 1909, p. 416; Børgesen 1913, p. 135, fig. 108; Taylor 1928, p. 96.

The commonest member of the genus in the Caribbean area, except for *C. racemosa* and its varieties. The pluriseriate forms are found in moderately protected reef crevices and pools, the distichous and more lax forms in warm, well-protected pools and deep water. The range is from Bermuda and Florida to Brazil.

**var. *Lycopodium* (C. Agardh) Weber-van Bosse**

Plate 7, Fig. 2

BRITISH WEST INDIES: Tobago Island, occasional in shallows near the shore, Buccoo Bay, no. 39-508, 20 April 1939.

**var. *mamillosa* (Montagne) Weber-van Bosse**

PANAMA: Caledonia Harbor, from rocky ledges near Isla Piedra and I. San Augustin, no. 39-182, 3 April 1939; Caledonia Harbor, abundant in a hot, shallow tide pool near Isla Piedra and I. San Augustin, no. 39-234, 4 April 1939.

***Caulerpa racemosa* (Forsskål) J. Agardh**

Weber-van Bosse 1898, p. 357, pls. 33, 34 in part; Vickers 1908, p. 28, pl. 45 as var. *clavifera*; Collins 1909, p. 419; Børgesen 1913, p. 147, figs. 117-125; Taylor 1928, p. 101, pls. 12, 13 in part.

The commonest species of *Caulerpa* in the Caribbean area, and probably in all areas of the tropics where the genus is found. It is ex-

tremely variable, and varietal designation of many specimens is commonly impossible in any large collection. Some of the varieties are nearly or always associated with particular types of habitat, but others grow side by side under the same conditions. It is not unusual to find considerable variation between different assimilatory axes and their ramuli on different parts of one plant.

NETHERLANDS WEST INDIES: Curaçao Island, frequent between the rocks on Jan Thiel Beach, *no.* 39-588, 23 April 1939. VENEZUELA: Tortuga Island, fragments drifted upon the beach, *no.* 39-377a, 13 April 1939.

**var. *clavifera* (Turner) Weber-van Bosse**

PANAMA: Caledonia Harbor, frequent in shore collections, from rocks along the shore near Isla Piedra and I. San Augustin, *no.* 180a, 3 April 1939, and *no.* 39-232, 4 April 1939. NETHERLANDS WEST INDIES: Aruba Island, common on the rocks of the shore of the cove at Punta Basora, *no.* 39-327, 10 April 1939; Curaçao Island, on rocks along the shore of Valentijn's Bai, Willemstad, collected by F. H. Elmore, *no.* 39-577, 23 April 1939.

**var. *laetevirens* (Montagne) Weber-van Bosse**

Plate 7, Fig. 1

PANAMA: Caledonia Harbor, abundant in pools among the rocks along the shore near Isla Piedra and I. San Augustin, *no.* 39-230, 4 April 1939. NETHERLANDS WEST INDIES: Aruba Island, infrequent among the rocks of the shore of the cove at Punta Basora, *no.* 39-328, 10 April 1939. VENEZUELA: Cubagua Island, abundant from ledges and scattered rocks on the beach, *no.* 39-449, 14 April 1939.

**var. *microphysa* (Weber-van Bosse) Taylor**

PANAMA: Caledonia Harbor, specimens approaching this variety from rocks along shore near Isla Piedra and I. San Augustin, *no.* 39-231, 4 April 1939. COLOMBIA: Dredged at 24 meters' depth from a bottom of gray sand, sta. A13 near Cape LaVela, *no.* 39-258, 8 April 1939. VENEZUELA: Tortuga Island, fragments approaching this variety were thrown upon the beach in small quantity at Punta Arenas, *no.* 39-377b, 13 April 1939; dredged at 3.5-9.0 meters' depth from a bottom of coral sand and other algae at sta. A22 near Tortuga Island, *no.* 39-424, 13 April 1939.

var. *uvifera* (Turner) J. Agardh

PANAMA: Caledonia Harbor, on rocks along shore near Isla Piedra and I. San Augustin, *no. 39-180b*, 3 April 1939. BRITISH WEST INDIES: Tobago Island, very abundant in pools on Buccoo Reef, *no. 39-510*, 20 April 1939.

## Codiaceae

Plants coenocytic, filamentous, the filaments branched, the branches in turn arranged to give form to the plant. In many cases they are twisted and interwoven to produce a tough, spongy axis; in others they lie roughly parallel, although joined laterally more or less firmly; in a few cases in the distal part of the plant the filaments become free. Commonly the peripheral branch filament tips become specialized and form a cortex about a corded filamentous axis.

## KEY TO GENERA

1. Plants completely uncalcified . . . . . 2
1. Plants at least in part calcified . . . . . 3
2. Plant sessile and lobed or freely branched, without a distinctive stipe . . . . . Codium
2. Plant with a cylindrical base and more or less lobed or simple and expanded distal flabellum . . . . . Avrainvillea
3. Plants not segmented . . . . . 4
3. Plants segmented . . . . . Halimeda
4. Plants with an apical tuft of free filaments on a stout stalk . . . . . Penicillus
4. Plants with one or more flat blades on the end of the stalk 5
5. Plant with the upper part of the stalk bearing many little, thin, overlapping blades . . . . . Rhipocephalus
5. Plant ending in a single, though sometimes proliferous, blade . . . . . Udotea

## CODIUM Stackhouse, 1797

Plants thickly encrusting, lobed, or branched and decumbent, or most commonly erect and bushy from a small cushionlike holdfast, of moderate to large size, dark green, tough and somewhat spongy; coenocytic, composed of branching filaments which intertwine to form the massive plant, the filament tips oriented at right angles to the surface and inflated to

form peripheral utricles, which are sometimes partly cut off by thickening of the cell membrane at the base, and which bear hyaline branched hairs and, in season, gametangia.

### KEY TO SPECIES

1. Plants appressed, often slightly lobed but encrusting; peripheral utricles with pitted end walls . . . *C. intertextum* v. *cribrosum*
1. Plants decumbent, freely branched, the branches often adherent to the substratum by tufts of rhizoids; peripheral utricles about 125-225  $\mu$  diam., the end walls not particularly thick . . . . . *C. repens*
1. Plants erect . . . . . 2
2. Plants cylindrical throughout . . . . . 3
2. Plants flattened at the dichotomies . . . . . 4
3. Plants smaller, about 1.5 dm. tall, densely branched, dark green in color, the branches not constricted; peripheral utricles generally 175-225  $\mu$  diam., the end wall not particularly thick . . . . . *C. dichotomum*
3. Plants larger, about 2 dm. tall, loosely branched and relatively light green in color, the branches frequently locally constricted, especially above a fork; peripheral utricles generally about 250-300  $\mu$  diam., the end walls considerably thickened . . . . . *C. isthmocladum*
4. Plants smaller, usually under 2 dm., closely and irregularly branched, densely crowded, the end segments short and not distinctive; peripheral utricles 125-290  $\mu$  diam., with much thickened end walls . . . . . *C. Pilgeri*
4. Plants large, to 3 dm. or more, regularly subdichotomously branched, the end segments long-cylindrical or flagelliform, the flattened forks often very broad; peripheral utricles 300-500  $\mu$  diam., the end membrane not particularly thickened . . . . . *C. decorticatum*

***Codium intertextum* Collins and Hervey, var. *cribrosum* Howe**

Howe 1920, p. 617; Taylor 1928, p. 79, pl. 6, fig. 13.

Not to be distinguished from the species except by microscopic study of the ends of the peripheral utricles, which are then seen to be more or less pitted. Of the two specimens, the first collected on this expedition showed only occasional pitting. The plant has been reported from Flor-



ida, the Bahamas, Jamaica, Puerto Rico, and now from islands nearer to the South American mainland. It grows on, and especially under the overhanging edges of, coral rocks and ledges in shallow water.

NETHERLANDS WEST INDIES: Curaçao Island, growing with and attached to *C. repens* on old coral rocks, Jan Thiel Beach, no. 39-595b, 23 April 1939. VENEZUELA: Cubagua Island, growing under coral rock ledges along the sandy beach, no. 39-465, 14 April 1939.

### ***Codium repens* (Crouan) Vickers**

Schramm and Mazé 1865, p. 47 as *C. tomentosum* var. *subsimplex* Crouan, 1866, p. 115 as *C. tomentosum* var. *reptans* Crouan; Mazé and Schramm 1870-77, p. 107 as *C. tenue* var. *repens* Crouan; Vickers 1905, p. 56, 1908, p. 23, pl. 29; Collins 1909, p. 388; Schmidt 1923, p. 43, fig. 23; Taylor 1928, p. 80, pl. 6, fig. 8, pl. 7, fig. 8.

Seldom reported, being previously known from Florida, Guadeloupe, and Barbados only. This plant is found in the littoral region, principally in rock crevices and under the edges of large boulders, where if exposed at low tide it is protected from drying. The fact that the spreading branches are able to form secondary haptera enables the plant to maintain its spreading habit in these localities even when laid bare at low water.

NETHERLANDS WEST INDIES: Curaçao Island, growing upon and somewhat loosely attached to old coral rock, Jan Thiel Beach, no. 39-595a, 23 April 1939.

### ***Codium dichotomum* (Hudson) Setchell**

Vickers 1908, p. 22, pl. 26; Collins 1909, p. 388; Børgesen 1913, p. 115; Howe 1920, p. 616; Schmidt 1923, p. 39, figs. 20, 21; Taylor 1928, p. 81, pl. 6, fig. 16, pl. 7, fig. 4 (all as *C. tomentosum* [Hudson] Stackhouse); Setchell 1931, p. 361.

This, the classical species of the genus, has been reported from all districts of the area with which we are concerned, so far as collections have been made. Though no doubt some of the earlier records are based on mistaken identifications, it is probable that this wide distribution is correctly judged. This species may be expected on rocks in shallow water, and in large tide pools.

NETHERLANDS WEST INDIES: Aruba Island, rare on worn coralline rocks along the shore of the cove at Punta Basora, no. 39-310, 10 April 1939; Curaçao Island, infrequent on massive broken corals along the shore, Jan Thiel Beach, no. 39-594, 23 April 1939.

**Codium isthmocladum** Vickers

Vickers 1905, p. 57, 1908, p. 23, pl. 28; Collins 1909, p. 388; Børgesen 1913, p. 115; Howe 1920, p. 617; Schmidt 1923, pp. 10, 43, figs. 3, 24; Taylor 1928, p. 79, pl. 6, figs. 10, 15, pl. 7, fig. 10.

A rather large, loosely branched plant, light green in color, which is found in water of moderate to rather considerable depth attached to large coral fragments and the like. It is known from Bermuda and Florida to the West Indies and Venezuela.

PANAMA: Caledonia Harbor, common on rocks in rather shallow water near Isla Piedra and I. San Augustin, *no. 39-162*, 3 April 1939. COLOMBIA: Dredged in some quantity from 24 meters off a gray sand bottom at sta. A13 near Cape LaVela, *no. 39-260*, 8 April 1939. VENEZUELA: Tortuga Island, infrequently washed ashore on Punta Arenas, *no. 39-415*, 13 April 1939. BRITISH WEST INDIES: Trinidad Island, dredged at 2-5 meters on a bottom of sand and algae in Port-of-Spain Harbor at sta. A35, *no. 39-485*, 18 April 1939; Tobago Island, occasional small plants at Buccoo Bay, *no. 39-507*, 20 April 1939.

**Codium Pilgeri** O. C. Schmidt

Schmidt 1923, p. 44, figs. 25, 26; Taylor 1928, p. 80, pl. 6, fig. 9, pl. 7, fig. 3.

Known from a few stations between Bermuda and Brazil, including Florida. This is a species which is usually found in quite shallow water, especially large tide pools, attached to coral rocks. The material from the present expedition showed rather thicker branches than the writer had found in Florida material, and somewhat more regular branching. However, the distinctive thick wall of the tips of the peripheral utricles was evident.

COLOMBIA: Dredged from 16-18 meters' depth off a bottom with coralline algae near Bahia Honda at sta. A15, *no. 39-282*, 8 April 1939, juvenile and determination tentative. BRITISH WEST INDIES: Tobago Island, frequent on rocks, Buccoo Bay, *no. 39-506*, 20 April 1939.

**Codium decorticatum** (Woodward) Howe

Plate 8, Fig. 2

Vickers 1908, p. 22, pl. 27; Collins 1909, p. 388 (both as *C. elongatum*); Howe 1911, p. 494; Børgesen 1913, p. 116 (as *C. elongatum*); Schmidt 1923, p. 52, fig. 36; Taylor 1928, p. 78, pl. 6, fig. 14.

A very conspicuous, but not particularly common alga, mostly from water of moderate depths; its reported range is from Bermuda and North Carolina to Brazil, though at but few stations in our area.

COLOMBIA: Dredged up on the anchor chain with *Sargassum*, from a depth of 9 meters off Cape LaVela at sta. A12a, no. 39-277, 8 April 1939. VENEZUELA: Tortuga Island, occasional specimens washed ashore at Punta Arenas, no. 39-416, 13 April 1939. BRITISH WEST INDIES: Tobago Island, numerous specimens brought ashore by a seine on the beach, Buccoo Bay, no. 39-505, 20 April 1939.

### AVRAINVILLEA Decaisne, 1842

#### *Avrainvillea Rawsonii* (Dickie) Howe

Plants more or less clustered, dull or brownish green, below barely stalklike, above dividing into irregular digitate lobes which are more or less terete; lobes 4-12 cm. long, 0.5-4.0 cm. diam., somewhat soft and with a rather loosely spongy surface; structural filaments of the lobes subcylindrical within, subtorulose toward the surface, constricted above the dichotomies.

Howe 1907, p. 510, pl. 30.

This plant has been reported in the West Indies from the Bahamas to Barbados, though in but a few localities. As found, it was inconspicuous, hardly showing above the muddy bottom of the warm tide pool in which it grew. Most species in the genus have a flat, rounded blade, this being exceptional.

PANAMA: Caledonia Bay, abundant in a very shallow pool near Isla Piedra and I. San Augustin, no. 39-236, 4 April 1939.

### HALIMEDA Lamouroux, 1812

Plants moderately large, solitary, gregarious or forming spreading colonies, with a massive rhizoidal base, a short stipe and branched upper portion, or in colonial masses losing any single distinctive base and attaching at various places; branches segmented, the segments cylindrical or flattened, circular or somewhat lobed, lightly to considerably calcified, except between the segments.

### KEY TO SPECIES

1. Branching in more than one plane, at least below . . . *H. Opuntia*  
Segments throughout the plant rounded or reniform . . . *f. typica*

- Segments similar but larger, more auriculate, tending to overlap . . . . . f. *cordata*
- Segments, at least in the lower part of the plant, deeply three-lobed . . . . . f. *triloba*
1. Branching characteristically in a single plane (often much distorted) . . . . . 2
  2. Upper segments with an entire outline . . . . . 3
  2. Upper segments markedly crenate or lobed . . . . . H. *tridens*  
 Segments in the upper part of the plant rounded, or slightly three-lobed . . . . . f. *typica*  
 Segments in the upper part of the plant deeply tripartite, the divisions often nearly cylindrical . . . . . f. *tripartita*
  3. Upper segments cylindrical . . . . . H. *Monile*
  3. Upper segments flat . . . . . 4
  4. Very slightly calcified, segments broad and soft . . . . . H. *discoidea*
  4. Moderately calcified, segments darker and firmer . . . . . 5
  5. Segments quite entire and plane . . . . . H. *Tuna*
  5. Segments faintly ribbed and margin slightly crenate . . . . . H. *simulans*

**Halimeda tridens** (Ellis and Solander) Lamouroux

Harvey 1858, p. 24, pl. 44, fig. C1; Barton 1901, p. 25, pl. 4, figs. 39, 43 (as *H. incrassata* ff. *typica* and *tripartita*); Howe 1907, p. 501; Collins 1909, p. 398; Børgesen 1913, p. 109 (as *H. incrassata*); Taylor 1928, p. 84, pl. 10, figs. 14, 16, 19, pl. 11, fig. 20 (incl. ff. *typica* and *tripartita*).

A common species of warm, quiet, and sandy shallows, found throughout our area from Bermuda to Venezuela.

**f. tripartita** (Barton) Collins

PANAMA: Dredged at 2-13 meters' depth from a bottom of mud and fine sand at sta. A2 near Caledonia Harbor, no. 39-210, 3 April 1939; Caledonia Harbor, found abundantly in shallow water with the aid of a diving helmet along the shore near Isla Piedra and I. San Augustin, no. 39-169b, 3 April 1939.

**f. typica** (Barton) Collins

PANAMA: Caledonia Harbor, a few specimens from shallow water near Isla Piedra and I. San Augustin, no. 39-224b, 3 April 1939; secured in abundance in similar places near by with the aid of a diving helmet, no. 39-169a, 3 April 1939. NETHERLANDS WEST INDIES: Curaçao Is-

land, common in shore collections from Valentijn's Bai, Willemstad, coll. F. H. Elmore, no. 39-568, 23 April 1939.

**Halimeda Monile** (Ellis and Solander) Lamouroux

Barton 1901, p. 27, pl. 4, fig. 40 (as *H. incrassata* forma *monilis*); Howe 1905, p. 564 (as *H. tridens Monile*); Collins 1909, p. 399; Børgesen 1913, p. 112, figs. 90, 91 (as *H. incrassata* var. *monilis* ff. *robusta* and *cylindrica*); Taylor 1928, p. 82, pl. 10, fig. 1.

This is a common *Halimeda* of shallow water, frequenting the same kinds of locations and often mixed with, but adequately distinct from, *H. tridens*, which is even more common. It has, in our area, been reported between Bermuda and Venezuela.

PANAMA: Caledonia Harbor, scarce among collections from sandy shallows near Isla Piedra and I. San Augustin, no. 39-161, 3 April 1939; *ibid.*, dredged from a depth of 2-13 meters off a bottom of mud and fine sand at sta. A2, no. 39-209, 3 April 1939. VENEZUELA: Dredged at 3.5-9.0 meters' depth from a bottom of coral sand and algae at sta. A22 near Tortuga Island, no. 39-427, 13 April 1939.

**Halimeda simulans** Howe

Howe 1907, p. 503, pl. 29; Collins 1909, p. 401; Børgesen 1913, p. 114, fig. 92 (as *H. incrassata* var. *simulans*); Taylor 1928, p. 84, pl. 10, fig. 12, pl. 11, figs. 18, 19.

Already known from several stations between Bermuda and Colombia, although as yet not reported many times. This species is sometimes found in shallow water, sometimes is dredged in water of quite moderate depth.

PANAMA: Caledonia Harbor, infrequent in shallow water along the shore near Isla Piedra and I. San Augustin, no. 39-160, 3 April 1939.

**Halimeda Tuna** (Ellis and Solander) Lamouroux

Harvey 1858, p. 25, pl. 40, fig. A1; Barton 1901, p. 11, pl. 1, figs. 1, 4-6; Vickers 1908, p. 24, pl. 33; Collins 1909, p. 400; Børgesen 1913, p. 106; Taylor 1928, p. 85, pl. 10, fig. 8, pl. 11, fig. 21.

This is usually a common *Halimeda* in shallow water and has a wide range in the tropics; within our area it has been reported from Bermuda to Brazil.

PANAMA: Caledonia Harbor, abundant in deeper water along shore, attached to rocks in sandy shallows near Isla Piedra and I. San Augustin, no. 39-239, 4 April 1939.



***Halimeda discoidea* Decaisne**

Collins 1909, p. 400; Børgesen 1913, p. 106, fig. 86; Taylor 1928, p. 82, pl. 10, fig. 17, pl. 11, fig. 23.

Not frequently reported, but within our area the records are scattered from Florida to Martinique. This plant seems to be limited to water of moderate depths, and so is obtained only by dredging, except as it may occasionally be washed ashore.

PANAMA: Dredged in some quantity at 14-25 meters' depth from a bottom of mud and shells at sta. A4 off Caledonia Bay, *no.* 39-216, 3 April 1939. COLOMBIA: Dredged in abundance at 16-18 meters' depth off a bottom marked by coralline algae at sta. A15 off Bahia Honda, *no.* 39-287, 8 April 1939.

***Halimeda Opuntia* (Linnaeus) Lamouroux**

Harvey 1858, p. 23, pl. 40, fig. B1; Barton 1901, p. 18, pl. 2, figs. 19-21, 25-27; Vickers 1908, p. 25, pl. 35; Collins 1909, p. 400; Børgesen 1913, p. 108; Taylor 1928, p. 82, pl. 10, figs. 2, 5-7, pl. 11, fig. 17.

This is probably the commonest and most widespread of all species of *Halimeda*, familiar as forming large colonies in shallow, relatively quiet water. It has been reported from many stations between Bermuda and Brazil.

**f. *cordata* (J. Agardh) Barton**

VENEZUELA: Dredged at 39-41 meters from a bottom of massive broken corals at sta. A44 off Tortuga Island, *no.* 39-560a, 21 April 1939.

**f. *triloba* (Decaisne) Barton**

PANAMA: Dredged at 14-25 meters' depth from a bottom of mud and shell at sta. A4 near Caledonia Harbor, *no.* 39-218, 3 April 1939. NETHERLANDS WEST INDIES: Curaçao Island, abundant in colonies along the shore, Jan Thiel Beach, *no.* 39-612, 23 April 1939.

**f. *typica* Barton**

PANAMA: Caledonia Harbor, frequent on rocks, and rather buried by sand, in shallow water near Isla Piedra and I. San Augustin, *no.* 39-159, 3 April 1939. NETHERLANDS WEST INDIES: Aruba Island, occasional large tufts along the shore in shallow water of the cove at Punta Basora, *no.* 39-324, 10 April 1939; Curaçao Island, common in shore collections from Valentijn's Bai, Willemstad, coll. F. H. Elmore, *no.* 39-569, 23

April 1939. BRITISH WEST INDIES: Tobago Island, infrequently washed ashore in Rockly Bay, no. 39-493, 19 April 1939; abundant among the broken coral masses, Buccoo Reef, no. 39-512b, 20 April 1939.

### PENICILLUS Lamarck, 1813

Plants solitary or gregarious, from a cluster of rhizoidal filaments rising with a stout cylindrical stipe, terminating in a brushlike tuft of coarse, branched filaments forming an oval or spherical capitulum.

#### KEY TO SPECIES

1. Stipe with a compact smooth surface, the corticating branchlets with obtuse, truncate, or capitate ends . . . . . 2
1. Stipe with a minutely spongy surface, the corticating branchlets tapering to pointed ends; filaments of the loose capitulum 150-320  $\mu$  diam. . . . . *P. pyriformis* f. *explanata*
2. Stipe firm, often more than twice as long as the capitulum; filaments of the capitulum 135-250  $\mu$  diam. . . . . *P. capitatus*
2. Stipe soft, about twice as long as the capitulum or less; filaments of the capitulum 300-550  $\mu$  diam. . . . . *P. Lamourouxii*

#### *Penicillus capitatus* Lamarck

Harvey 1858, p. 45, pl. 43, fig. B1; A. & E. S. Gepp 1911, p. 81, pl. 20, fig. 168c; Børgesen 1913, p. 97, fig. 79; Taylor 1928, p. 86, pl. 8, fig. 2, pl. 9, figs. 4, 16.

Widely distributed in the tropics, growing in sheltered locations on a sandy or muddy bottom in shallow water. In our area reported from Bermuda south to Venezuela.

PANAMA: Caledonia Harbor, common in inshore sandy shallows near Isla Piedra and I. San Augustin, no. 39-153a, 3 April 1939; also in similar localities, no. 39-221, 4 April 1939; dredged at 2-13 meters' depth from a bottom of mud and fine sand at sta. A2 near Caledonia Harbor, no. 39-208a, 3 April 1939. NETHERLANDS WEST INDIES: Curaçao, one dwarf specimen collected along the shore of Valentijn's Bai, Willemstad, F. H. Elmore, no. 39-567, 23 April 1939.

#### *Penicillus Lamourouxii* Decaisne

Plate 8, Fig. 1

Collins 1909, p. 392; A. & E. S. Gepp 1911, p. 78, pl. 19, figs. 160, 161, 163; Børgesen 1913, p. 98; Taylor 1928, p. 86, pl. 8, fig. 3, pl. 9, figs. 3, 19.

A plant less common than *P. capitatus*, but found in similar situations from Florida to Venezuela.

PANAMA: Caledonia Harbor, infrequent in sandy shallows near Isla Piedra and I. San Augustin, no. 39-153b, 3 April 1939. Dredged with *P. capitatus* at sta. A2 near Caledonia Harbor, no. 39-208b, 3 April 1939.

**Penicillus pyriformis** A. & E. S. Gepp,

approaching f. **explanata** Børgesen

Børgesen 1913, p. 99, fig. 82; Taylor 1928, p. 87, pl. 8, fig. 5.

Known previously only from the Virgin Islands and Florida, this is probably a somewhat deep-water form of the relatively common *P. pyriformis*, which has a wider range.

PANAMA: Caledonia Harbor, infrequent, collected with the aid of a diving helmet from a bottom of fine sand and mud in 2.5-3.5 meters of water near Isla Piedra and I. San Augustin, no. 39-167, 3 April 1939.

**RHIPOCEPHALUS** Kützing, 1843

**Rhipocephalus Phoenix** (Ellis and Solander) Kützing

Plants solitary or gregarious, from a cluster of rhizoidal filaments rising with a stout cylindrical stipe, terminating in a capitulum which consists of clustered, pedicellate, cuneate, unilamellate flabellae, which are arranged in overlapping acropetal series toward the tip of the axis.

Harvey 1858, p. 46, pl. 43, figs. C1-3 (as *Penicillus Phoenix*); A. & E. S. Gepp 1911, p. 93, pl. 21, figs. 183-188; Taylor 1928, p. 88, pl. 8, figs. 7, 8, pl. 9, fig. 21.

Reported from Florida to Colombia, a not infrequent plant in protected, sandy shallows.

PANAMA: Caledonia Harbor, common in sandy shallows near Isla Piedra and I. San Augustin, no. 39-154, 3 April 1939, and no. 39-220, 4 April 1939.

**UDOTEA** Lamouroux, 1813

Plants solitary or gregarious, from a small, firm cluster of rhizoidal filaments arising with a short, stout cylindrical stipe which expands above into a cuneate to reniform, simple or proliferous, plane or somewhat plicate, rarely infundibuliform, calcified flabellum which is sometimes cleft to rather narrow segments.

## KEY TO SPECIES

1. Blade naked, the branching filaments of the blade not bearing corticating branchlets like those of the stipe . . . *U. conglutinata*
1. Blade corticated, the medullary filaments of the blade forming short truncate branchlets which produce a firm, smooth cortex . . . . . *U. Flabellum*

*Udotea conglutinata* (Solander) Lamouroux

Harvey 1858, p. 27, pl. 40, figs. C1-5; A. & E. S. Gepp 1911, p. 114, pl. 5, figs. 44, 45, pl. 6, fig. 46; Taylor 1928, p. 89, pl. 8, fig. 13, pl. 9, figs. 11, 22.

A rather common tropical marine alga, occurring in sandy shallows and to moderate depths; it has been reported from Bermuda to Brazil.

PANAMA: Caledonia Harbor, infrequent in sandy inshore shallows near Isla Piedra and I. San Augustin, *no. 39-156*, 3 April 1939; in similar situations, collected with the aid of a diving helmet in 3.5-5.5 meters on a sandy bottom, *no. 39-166*, 3 April 1939. COLOMBIA: One specimen, dwarf or juvenile, dredged from 24 meters off a bottom of gray sand at sta. A13 near Cape LaVela, *no. 39-267*, 8 April 1939.

*Udotea Flabellum* (Ellis and Solander) Howe

A. & E. S. Gepp 1911, p. 131, pl. 3, figs. 26-28; Børgesen 1913, p. 104; Taylor 1928, p. 90, pl. 7, fig. 9, pl. 9, figs. 2, 6.

A common tropical marine alga, occurring in shallow, protected waters on a soft or sandy bottom; it is found in the tropics of both hemispheres, and with us has been reported from Bermuda to Brazil.

PANAMA: Caledonia Harbor, frequent in inshore sandy shallows near Isla Piedra and I. San Augustin, *no. 39-155*, 3 April 1939; also frequent at 1 meter's depth in a lagoon behind mangrove thickets near the harbor entrance, *no. 39-619a*, 27 April 1939. COLOMBIA: Rare as dredged at 16-18 meters' depth from a bottom with considerable coralline algae at sta. A15 near Bahia Honda, *no. 39-279*, 8 April 1939.

## Phyllosiphonaceae

Filamentous coenocytic plants, the coenocytes branching irregularly; endophytic algae, and algae boring in shells.

**OSTREOBIMUM** Bornet and Flahault, 1889***Ostreobium Quekettii*** Bornet and Flahault

Plants microscopic, endozoic, of nonseptate filaments which branch, occasionally anastomose, and are locally much enlarged and irregular, the diameter in the slender portions varying from about 2-5  $\mu$ , and in the swollen portions to 40-50  $\mu$ .

This plant is known from north temperate waters; its discovery in the tropics represents a marked extension of range. It is found in old mollusk shells.

COLOMBIA: In old shells dredged from a bottom marked chiefly by coralline algae, at 14-16 meters' depth, sta. A15 near Bahia Honda, no. 39-300, 8 April 1939.



## PHAEOPHYCEAE

### Ectocarpaceae

Plants filiform, branched, basally attached, free above; reproduction in intercalary or lateral organs replacing branchlets, ordinarily asexually by zoospores produced in unilocular sporangia, and sexually by iso- or anisogametes produced in plurilocular gametangia, the alternating generations on separate plants, with meiosis occurring in the sporangia.

#### ECTOCARPUS Lyngbye, 1819

Plants filamentous, microscopic to sometimes large, and forming extensive soft tufts; filaments uniseriate, attaching by a disklike hapteron or rhizoidal extensions of the basal cells, creeping below or erect, sparingly to freely, generally alternately, branched, the branches similar to the axis, sometimes terminating in few-celled, attenuate hairlike tips. Reproduction by zoospores, produced in lateral sporangia, and by iso- or anisogametes, produced in lateral gametangia.

This is a genus fairly common in warm as it is in temperate regions, and the variety of species known from the American tropics is considerable. However, even more frequently than in the north, the plants are sterile and indeterminable. At any single place and time it is, therefore, not usual to find more than one or two of the larger species—if that—in identifiable condition. Quite a number of specimens were collected on the Hancock Expedition which were sterile.

#### KEY TO SPECIES

1. Plants microscopic, creeping below, the erect branches seldom divided, the gametangia chiefly on the basal part or on the lower part of the erect branches, 15-25  $\mu$  diam., 100-140  $\mu$  long . . . . . *E. elachistaeformis*
1. Plants larger . . . . . 2
2. Plants small, forming more or less ropy tufts or spongy masses; short, relatively few-celled branches ending in a hooked tip common; gametangia small, oval to subspherical, about 62  $\mu$  long and 57  $\mu$  in diameter . . . *E. breviararticulatus*
2. Plants sometimes becoming a good deal larger, a few centimeters in height, soft and tufted but not ropy, creeping below, above irregularly and sparingly branched; gametangia sessile,

cylindrical to clavate, rounded to subtruncate at the apex, of  
a few tiers of cells, 19-50  $\mu$  diam., 112-250  $\mu$  long . . .

. . . . . E. Duchassaingianus

### ***Ectocarpus elachistaeformis* Heydrich**

Børgesen 1914, p. 18, fig. 137; Taylor 1928, p. 107, pl. 14, fig. 12.

A minute epiphytic species which is known from but few stations; within our area it has been reported from Bermuda, Florida, and the Virgin Islands.

BRITISH WEST INDIES: Tobago Island, epiphytic on the leaves of *Thalassia*, Buccoo Bay, no. 39-557c, 20 April 1939.

### ***Ectocarpus breviarticulatus* J. Agardh**

Vickers 1908, p. 43, II pl. 29 (as *E. hamatus*); Børgesen 1914, p. 173, fig. 136.

A small species found on rocks in shallow water; it is known from a few stations in the Lesser Antilles.

NETHERLANDS WEST INDIES: Aruba Island, forming abundant small, pale tufts on rocks near the high-tide line in the cove at Punta Basora, no. 39-330, 10 April 1939; Curaçao Island, occasional, forming little ropy tufts on broken corals along the shore, Jan Thiel Beach, no. 39-601, 23 April 1939.

### ***Ectocarpus Duchassaingianus* Grunow**

Vickers 1908, p. 42, II pl. 27; Børgesen 1914, p. 3, figs. 127-128; Taylor 1928, p. 107, pl. 14, fig. 11.

A small species, found on stones, wharves, or sometimes epiphytic on algae or marine spermatophytes in shallow water; within our range it has been reported from several stations between North Carolina and Barbados.

NETHERLANDS WEST INDIES: Aruba Island, abundant as an epiphyte on *Chnoospora*, found on the rocks between tide marks in the cove at Punta Basora, no. 39-308, 10 April 1939; Curaçao Island, very common on the rocks along the shore, Jan Thiel Beach, no. 39-602, 23 April 1939. BRITISH WEST INDIES: Tobago Island, epiphytic on leaves of *Thalassia*, Buccoo Bay, no. 39-557c in minor part, 20 April 1939.

## Ralfsiaceae

Crustose plants, composed of radial filament systems laterally united to form a horizontal layer from which arise series of cells to form a more or less firm cortex; plurilocular gametangia and unilocular sporangia in superficial sori on different plants, often associated with paraphyses.

### **RALFSIA** Berkeley, 1843

#### **Ralfsia expansa** J. Agardh

Crustaceous plants, composed of branching filaments more or less parallel and united into a firm layer from which branches curve up to lie at right angles to the upper surface; reproductive organs closely borne on the upper surface in broad sori, the gametangia slenderly cylindrical, the pyriform unilocular sporangia 75-120  $\mu$  long, 30  $\mu$  diam., basally attached to long-clavate paraphysal filaments 100-170  $\mu$  long, with lower cells 2-5 diameters long.

Børgesen 1914, p. 33, figs. 146-148; Taylor 1928, p. 115, pl. 18, fig. 18, pl. 37, figs. 1-3.

Reported from a few stations between Florida and Tobago, these are crustaceous plants forming a tough dark-brown coat over rocks, shells, or wood, especially in the intertidal zone.

NETHERLANDS WEST INDIES: Curaçao Island, abundant on old Lithothamnidae found among the rocks on the shore, Jan Thiel Beach, no. 39-613, 23 April 1939.

## Chordariaceae

Plants subspherical to filiform, simple or branched, of filamentous construction within a gelatinous matrix, a core of relatively colorless interwoven filaments giving off lateral chromatophore-bearing assimilatory branches which constitute the cortex; colorless hairs with basal growth usually abundant; unilocular sporangia and plurilocular gametangia formed from branchlets of the cortical filaments, usually on separate plants.

### **AEGIRA** Fries, 1825

#### **Aegira Zosteræ** (Mohr) Fries

Plants somewhat irregularly bushy from an inconspicuous holdfast, 0.5-1.5, rarely 2.0 dm. tall, the branching alternate, flagelliform above,

the branches somewhat tapering upward, often of irregular contour and nodulose, exceedingly slippery; structurally of interwoven filaments, the peripheral filaments closely divided, finally moniliform with spheroidal cells near the surface; plurilocular gametangia short siliquose, often crowded unilaterally on the upper cells of assimilators; unilocular sporangia formed near the bases of the tufts of assimilators, ovoid to sub-globular, 50-100  $\mu$  long, 25-70  $\mu$  diam.

Børgesen 1914, p. 28, figs. 144, 145 (as *Castagnea Zosteræ*); Taylor 1928, p. 112, pl. 14, figs. 20-22, pl. 15, fig. 9; 1937, p. 141, pl. 10, figs. 10-11, pl. 12, fig. 2.

This plant, in one form or another, is found in both the temperate and tropical regions, chiefly as an epiphyte on coarser algae and aquatic phanerogams in relatively shallow water. The plant which passes under this name from the American tropics is consistently much more extensively branched and less nodulose than that designated by the same name in the northwestern Atlantic, and may perhaps prove specifically distinct. It has been reported from North Carolina to Guadeloupe.

PANAMA: Caledonia Harbor, abundant at 1.5-3.0 meters on leaves of *Thalassia* growing in the sand near Isla Piedra and I. San Augustin, no. 39-176, 3 April 1939. VENEZUELA: Tortuga Island, occasional plants in poor condition washed ashore on Punta Arenas, no. 39-397, 13 April 1939.

### Asperococcaceae

Plants of moderate size, elongate cylindrical, simple or fairly stoutly branched, or of simple rounded outlines; structurally appearing parenchymatous, the inner cells being very large and without many chromatophores, the outer being much smaller, and in the assimilatory layers crowded with chromatophores; sporangia and gametangia commonly developed directly from the surface cells.

#### KEY TO GENERA

1. Plant irregularly lobed, or rounded, but not freely branched . . . . . 2
1. Plant widely branched . . . . . 3
2. Plant with a continuous surface . . . . . *Colpomenia*
2. Plant clathrate, somewhat netlike, with coarse meshes . . . . . *Hydroclathrus*

3. Plant of relatively delicate texture, becoming hollow, easily torn, the branches tapering, terete . . . . . Rosenvingea
3. Plant relatively tough, the branches compressed, little tapered except near the tips . . . . . Chnoospora

### CHNOOSPORA J. Agardh, 1847

#### *Chnoospora pacifica* J. Agardh

Plate 9, Figs. 1, 2

Plants tufted, 3-15 cm. tall, somewhat gregarious, wiry and dark brown below, a little lighter above and firm, though somewhat more soft; branching irregularly dichotomous, somewhat expanded below the forks, up to 3-4 mm. wide, somewhat contracted above them, throughout the upper part of the plant the branches compressed, 1-2 mm. wide; toward the tips, particularly the last divisions, acutely tapering.

Harvey 1852, p. 79, pl. 4, figs. C1-4 (as *C. fastigiata*).

Rather seldom reported from the Caribbean area, but known from Panama, Venezuela, Guadeloupe, and Brazil. These plants are found on rocks in shallow water, primarily in the intertidal region. In places receiving severe surf the individuals are often small and densely crowded, but where the wave action is less they reach a considerable height.

NETHERLANDS WEST INDIES: Aruba Island, frequent in large tufts on rocks in the deeper tide pools of the cove at Punta Basora, no. 39-307, 10 April 1939; Curaçao Island, common on rocks along the shore, but small and wiry, Jan Thiel Beach, no. 39-600, 23 April 1939.

### COLPOMENIA Dèrbes and Solier, 1856

#### *Colpomenia sinuosa* (Roth) Dèrbes and Solier

Plant small, spherical, or when larger, flattened, becoming irregular and lobed, reaching a diameter of a few centimeters; hollow, the inner tissues of large and thin-walled colorless cells, the outermost 2 or 3 layers of small cells with numerous chromatophores; producing columnar plurilocular gametangia in dense sori from the surface layer.

Harvey 1852, p. 118, pl. 9, figs. C1-4 (as *Asperococcus sinuosus*); Vickers 1908, p. 40, II pl. 22; Børgesen 1914, p. 20, fig. 139; Taylor 1928, p. 110, pl. 7, fig. 1, pl. 19, figs. 3, 4.

Widely distributed in all tropical seas, a common species of shallow water, particularly reefs and tide pools. Known from Bermuda to Brazil.



PANAMA: Caledonia Harbor, occasional on other algae and on rocks, becoming large, from shallow water near Isla Piedra and I. San Augustin, no. 39-157, 3 April 1939; no. 39-245, 4 April 1939. NETHERLANDS WEST INDIES: Curaçao Island, small and infrequent on broken corals on the shore, Jan Thiel Beach, no. 39-589, 23 April 1939. VENEZUELA: Tortuga Island, infrequent as washed ashore near Punta Arenas, no. 39-406, 13 April 1939; Cubagua Island, infrequent but large on ledges and scattered rocks on the beach, no. 39-462, 14 April 1939.

### HYDROCLATHRUS Bory

#### *Hydroclathrus clathratus* (Bory) Howe

Plant reaching a diameter of a few decimeters, spreading and loosely attached by the under surface to rocks, becoming hollow and irregularly lobed, perforate and netlike.

Harvey 1852, p. 21, pl. 9, figs. A1-3; Vickers 1908, p. 41, II pl. 23; Børgesen 1914, p. 177, fig. 139 (all as *H. cancellatus*); Taylor 1928, p. 110, pl. 15, fig. 19, pl. 19, fig. 1.

Widely distributed in the tropical seas, a common species of shallow water, particularly reefs and tide pools. Known from Bermuda to Venezuela.

NETHERLANDS WEST INDIES: Aruba Island, abundant but only toward the south end of the cove, Punta Basora, no. 39-309, 10 April 1939; Curaçao Island, small and rare among broken corals on the shore, Jan Thiel Beach, no. 39-590, 23 April 1939. VENEZUELA: Tortuga Island, rare among the algae drifted ashore on Punta Arenas, no. 39-403, 13 April 1939.

### ROSENVINGEA Børgesen 1914

Branching plants forming considerable clumps, the branches often adherent and growing together where they touch; branches hollow in the wider portions at least, crisp, rather easily torn, cylindrical or somewhat flattened, dividing dichotomously or pseudodichotomously, frequently with proliferous branchlets on the main branch system; reproduction by cylindrical plurilocular gametangia formed in sori associated with a few colorless hairs.

#### KEY TO SPECIES

1. Branching erect, somewhat irregularly dichotomous, the branches 2.0-3.5 mm. diam. near the base of the plant, gradu-

- ally tapering toward the tips, which are not particularly closely branched; sori irregular in shape . . . *R. sanctae-crucis*
1. Branching wide-angled, very irregularly dichotomous, branches sometimes broad near the base of the plant, to 20 mm. or probably more, but near the closely branched tips often 1.0-0.1 mm., and sharply tapering; sori rounded . *R. intricata*

***Rosenvingea sanctae-crucis* Børgesen**

Plate 10, Fig. 1

Børgesen 1914, p. 22, figs. 140-143.

Previously known only from the Virgin Islands and Martinique, this record of *R. sanctae-crucis* from near the mainland is of considerable interest.

VENEZUELA: Tortuga Island, frequent among the algae drifted ashore on Punta Arenas, no. 39-398, 13 April 1939.

***Rosenvingea intricata* (J. Agardh) Børgesen**

Plate 10, Fig. 2

Vickers 1908, p. 41, pl. 24 (as *Striaria intricata*); Børgesen 1914, p. 26; Taylor 1928, p. 111, pl. 15, figs. 15-17.

Apparently widely distributed in the Caribbean region and other tropical American areas, this species has not been reported in very many places. It ranges from Bermuda and Florida to Brazil.

NETHERLANDS WEST INDIES: Aruba Island, a small amount in the cove at Punta Basora, no. 39-304, 10 April 1939; Curaçao Island, one small clump on Jan Thiel Beach, no. 39-606, 23 April 1939. VENEZUELA: Cubagua Island, rare in the drift washed ashore on the sandy beach, no. 39-463, 14 April 1939; dredged in considerable amount at 3.6 meters' depth from a bottom characterized by ample growth of algae, sta. A28 near Cubagua Island, no. 39-483, 15 April 1939. BRITISH WEST INDIES: Trinidad Island, dredged at 2-5 meters' depth from a sandy bottom with other algae at sta. A35 near Port-of-Spain, no. 39-489, 18 April 1939.

## Dictyotaceae

Plants of moderate size, one to several axes arising from a cushionlike holdfast, usually stupose at the base but without a distinctive stalk, though eventually often with the old denuded portion appearing stalk-like; above dividing into a flat bladelike part which may be filiform or

expanded, strap shaped or cuneate, fan shaped or reniform; growing from a marginal row of apical initials, or from a single apical cell, forming a parenchymatous blade; reproductive structures scattered or in sori on the surface, developed outwardly from the surface cells; asexual reproduction by tetraspores; sexual reproduction by antherozoids and eggs.

#### KEY TO GENERA

1. Thallus without a midrib . . . . . 2
1. Thallus with a distinct midrib . . . . . Dictyopteris
2. Thallus broad, simple or cleft, the segments more or less fan shaped . . . . . 3
2. Thallus segments not fan shaped . . . . . 4
3. Broad growing margin of the segments plane . . . . . Zonaria
3. Broad growing margin of the segments inrolled . . . . . Padina
4. Thallus strap shaped, branched, rarely to 1 cm. wide . . . 5
4. Thallus irregularly branched, becoming over 1 cm. wide, the margins lobed or irregularly dentate . . . . . Spatoglossum
5. Thallus in section showing in the older parts four or more layers of cells . . . . . Dilophus
5. Thallus in section of only three cell layers . . . . . Dictyota

#### ZONARIA Draparnaud, 1801

Plants tufted, often several blades ultimately arising from the same stupose base; blades flat, fan shaped to nearly reniform, sometimes becoming more or less split into narrow segments, sessile or in some species the lower part attenuate; blades generally firm and rather thick, brown, in some species markedly iridescent, sometimes zonate, not calcified; growing margin not inrolled.

#### KEY TO SPECIES

1. Thallus small, to 2-7 cm. long, more or less prostrate, when older becoming more or less free in the marginal portion, sparingly lobed or entire, vaguely zonate, crisp in texture, and light brown, not blackening on drying . . . . . *Z. variegata*
1. Thallus large, to 7-30 cm. tall, erect, repeatedly cleft into narrowly cuneate stipitate lobes unless growing in especially sheltered locations, flexible, dark brown, and often iridescent, blackening on drying . . . . . *Z. zonalis*

**Zonaria variegata** (Lamouroux) C. Agardh

Vickers 1908, p. 36, II pl. 6b; Taylor 1928, p. 124, pl. 15, figs. 20-22, pl. 17, fig. 4.

A rather common plant of the Caribbean region. It grows on rocks in shallow water and water of moderate depth, and usually is found in a small or ill-developed state quite tightly appressed and attaching to the substratum. It particularly affects the under side of rocks and coral masses and has been reported from North Carolina and Bermuda to Brazil.

PANAMA: Caledonia Harbor, infrequent on rocks in shallow water near Isla Piedra and I. San Augustin, *no. 39-158*, 3 April 1939. COLOMBIA: Scarce, dredged from 16-18 meters' depth off a bottom of coralline algae at sta. A15 near Bahia Honda, *no. 39-281*, 8 April 1939.

**Zonaria zonalis** (Lamouroux) Howe

Vickers 1908, p. 36, II pl. 6a (as *Zonaria lobata*); Taylor 1928, p. 125, pl. 17, fig. 3.

A widely distributed species, commonly reported in the West Indian region, chiefly from water of moderate depth where it grows on rocks and on broken corals. It has been reported from Bermuda to Brazil.

VENEZUELA: Tortuga Island, infrequent as washed ashore on Punta Arenas, *no. 39-368*, 13 April 1939. BRITISH WEST INDIES: Tobago Island, infrequently drifted ashore in Buccoo Bay, *no. 39-545*, 20 April 1939.

**PADINA** Adanson, 1763

Plants tufted, several blades ultimately arising from the same stupose base; blades flat or somewhat plicate, fan shaped to reniform, frequently becoming split into narrow segments, sessile or the lower part somewhat attenuate; blades generally thin and pale brown or straw color, sometimes darker brown, concentrically zonate, in some cases lightly calcified on one or both surfaces; growing margin inrolled; blade showing concentric rows of hairs, and the reproductive organs when present usually in bands with a prescribed arrangement with respect to the hair zones.

**KEY TO SPECIES**

1. Epidermis persistent as an indusium over the spores until they are ripe; spore bands alternating with the hair bands . *P. Vickersiae*

1. Epidermis not raised as an indusium over the spore band;  
spore band usually in the middle of each second zone between  
hair bands . . . . . *P. gymnospora*

### ***Padina Vickersiae* Hoyt**

Hoyt 1920, p. 456, pl. 92; Taylor 1928, p. 123, pl. 17, fig. 9.

A common species of the West Indian region, reported from North Carolina and Bermuda to Brazil. It is ordinarily found in quite shallow water, growing on rocks or coral fragments, but may be found in water of moderate depth also. This species, like others of the genus, is commonly found lining rock crevices or filling the opening of small fissures; in such places the blades are very small and closely crowded, usually sterile and quite indeterminable. In many places visited by the Hancock Expedition, *Padinas* were noted which were in this condition and which therefore do not appear in this report.

PANAMA: Caledonia Harbor, abundant in the shallows on broken corals near Isla Piedra and I. San Augustin, no. 39-172a, 3 April 1939. NETHERLANDS WEST INDIES: Dredged from 43 meters off a bottom of sand and coralline algae at sta. A18 near Aruba Island, no. 39-358 (determination not certain), 10 April 1939. COLOMBIA: Dredged from 9 meters' depth near Cape LaVela, at sta. A12a, no. 39-273 (determination not certain), 8 April 1939. VENEZUELA: Frequent on rocks in shallow water along the shore of Punta Arenas, no. 39-369a, 13 April 1939.

### ***Padina gymnospora* (Kützting) Vickers**

Kützting 1859, p. 29, pl. 71, fig. 2 (as *Zonaria gymnospora*); Vickers 1908, p. 37, II pl. 7.

A species of *Padina* frequently encountered in the West Indian region, growing on corals and rocks in very shallow water. It has been reported from Bermuda to Brazil.

PANAMA: Caledonia Harbor, abundant on coral fragments in shallow water near Isla Piedra and I. San Augustin, no. 39-172c, 3 April 1939. NETHERLANDS WEST INDIES: Aruba Island, common but mostly dwarf, in very shallow pools around the shore of the cove at Punta Basora, no. 39-316, 10 April 1939; Curaçao Island, small plants common on broken corals along the shore, Jan Thiel Beach, no. 39-591, 23 April 1939. VENEZUELA: Tortuga Island, common on rocks in shallow water on Punta Arenas, no. 39-369b, 13 April 1939.



**SPATOGLOSSUM** Kützing, 1843**Spatoglossum Schroederi** (Mertens) J. Agardh

Plate 11, Fig. 1

Plants somewhat bushy, from a contracted and thickened stupose base, to 2 dm. tall, branching dichotomously, or becoming somewhat irregular and palmatifid, frequently marginally proliferating, the branches thin and flat but firm of texture, to 2.5 cm. wide, the margin irregularly and sparingly serrate to dentate, the larger teeth commonly truncate or bifid; brown and often iridescent when living, becoming dark brown when dry.

Mertens in Martius 1828-34, p. 5, pl. 2, fig. III; Martius 1833, p. 21.

BRITISH WEST INDIES: Tobago Island, washed ashore in Buccoo Bay, no. 39-511b, 20 April 1939.

**DILOPHUS** J. Agardh, 1894**Dilophus guineensis** (Kützing) J. Agardh

Plants small, to about 1 dm. tall, bushy and branching, the branches flat, narrow, about 1 mm. broad, irregularly dichotomous to falsely alternately pinnate, tapering in the upper, more closely branched portion; structurally showing a single-celled cortical layer on each face and a medulla which is of more than one layer of cells at least in the older portion of well-developed plants.

Vickers 1908, p. 37, II pl. 9; Børgesen 1914, p. 58, figs. 164-165; Taylor 1928, p. 123.

Probably fairly frequent in the West Indian region, reported from Bermuda and Florida to Barbados and perhaps from Brazil. It has been reported chiefly from shallow water, but down to a depth of 10 meters in the Virgin Islands. It is not easy to distinguish some of the laxer forms of this species from *Dictyota cervicornis*, and sections must be made; usually the plant is more wiry and darker in color, more closely and apparently alternately branched.

NETHERLANDS WEST INDIES: Aruba Island, collected from shallow water along the shore of the cove at Punta Basora, no. 39-318, 10 April 1939. VENEZUELA: Tortuga Island, one piece washed ashore on the beach at Punta Arenas, no. 39-400a, 13 April 1939.

**DICTYOTA** Lamouroux, 1809

Plants bushy, not markedly stipitate, the base generally naked, dichotomously or alternately branching, the segments flat, narrow to moderately broad, with entire to dentate edges; growth of each branch from a large, broad apical cell; structurally showing a single-layered cortex on each face and a single medullary layer of much larger cuboidal cells with few chromatophores.

**KEY TO SPECIES**

1. Branching more or less regularly dichotomous . . . . . 2
1. Branching appearing alternate, the short lateral branchlets rounded-truncate, emarginate, or 2-3-dentate at the tips . *D. dentata*
2. Branch margin entire . . . . . 3
2. Branches rarely subentire, generally more or less strongly ciliate on the margin . . . . . *D. ciliolata*
3. Branching essentially regular . . . . . 4
3. Branching characteristically irregularly dichotomous, one member of the fork commonly remaining undivided or dividing less extensively than the other; generally narrow, erect-branched, bushy forms . . . . . *D. cervicornis*
4. Branches forming at very wide angles, characteristically 90°, often to 120° or more; plants intricately entangled; branches much wider in the lower portion of the plant than in the uppermost segments, where they may be filiform, the transition sometimes sharp . . . . . *D. divaricata*
4. Branches showing little or only moderate attenuation from the base of the plant to the apex, and formed at less extreme angles . . . . . 5
5. Branches essentially straight . . . . . 6
5. Branches spirally twisted . . . . . *D. volubilis*
6. Branches to 0.5-1.0 cm. wide . . . . . *D. dichotoma*
6. Branches about 1.0-1.5 mm. wide . . . . . *D. linearis*

***Dictyota dichotoma* (Hudson) Lamouroux**

Taylor 1928, p. 119, pl. 16, fig. 14.

A species commonly reported in tropical and subtropical waters of many parts of the world, and very variable. It has been reported from North Carolina and Bermuda to Brazil. The plant grows on stones, corals, and shells in water of moderate depth, from larger tide pools to

a depth of several meters. Large specimens are often proliferous at the margin, and when little developed this simulates the appearance of *D. ciliolata*.

COLOMBIA: Attached to drifting Sargassum taken 18 miles off Cape LaVela, no. 39-254, 7 April 1939; fragment dredged from 24 meters' depth off a bottom of gray sand at sta. A13 near Cape LaVela, no. 39-259 (determination doubtful), 8 April 1939; fragment dredged from 9 meters on Sargassum at sta. 12a, near Cape LaVela, no. 39-275 (determination doubtful), 8 April 1939. NETHERLANDS WEST INDIES: Common as dredged from a depth of 43 meters off a bottom of sand and coral-line algae at sta. A18 near Aruba Island, no. 39-354, 10 April 1939. VENEZUELA: Large, exceptionally well-developed plants dredged from a depth of 3.5-9.0 meters at sta. A24 near Cubagua Island, no. 39-477, 14 April 1939.

### *Dictyota linearis* (Linnaeus) Greville

Kützinger 1859, p. 9, pl. 21, fig. 2; Collins and Hervey 1917, p. 89.

The identification follows Collins' usage in his study of Bermuda algae, and is not intended to dispose of the question of the propriety of separation of this narrow form from *D. dichotoma*. There is no question of the distinctness of the forms as represented in the present collections; when a large collection is studied, a more serious problem is presented. In the plant under consideration the width reached about 1.5 mm., the distance between the forkings was generally about 1.5-2.0 cm., and the angles of divergence varied from about 30° to 60°, rarely more.

NETHERLANDS WEST INDIES: Curaçao Island, common as washed ashore in Valentijn's Bai, Willemstad, no. 39-571, 23 April 1939.

### *Dictyota cervicornis* Kützinger

Kützinger 1859, p. 11, pl. 24, fig. 2; Taylor 1928, p. 118, pl. 16, fig. 17.

A common and variable Caribbean species of shallow water, growing on stones, corals, and shells. It has been reported from Bermuda and Florida to Brazil.

PANAMA: Caledonia Harbor, narrow bladed, dark brown specimens frequent at 1.5-3.0 meters along the shore near Isla Piedra and I. San Augustin, no. 39-177, 3 April 1939. VENEZUELA: Tortuga Island, washed ashore on Punta Arenas, no. 39-400b, 13 April 1939; Cubagua Island, from ledges and scattered rocks along the beach, no. 39-468, 14

April 1939. BRITISH WEST INDIES: Tobago Island, occasional in Buccoo Bay, no. 39-521, 20 April 1939.

### ***Dictyota volubilis* Kützting**

Kützting 1859, pl. 13, fig. 2; Vickers 1908, p. 40, pl. 20.

Spiral forms in *Dictyota* are always puzzling; this one is much more like Vickers' figure than like the wide-angled plant with close, cervicorn branching figured as *D. cervicornis* f. *spiralis* by the writer in 1928.

VENEZUELA: Tortuga Island, with other *Dictyotas* on Punta Arenas, no. 39-400c, 13 April 1939.

### ***Dictyota divaricata* Lamouroux**

Taylor 1928, p. 120, pl. 16, figs. 6-9.

A common and widely distributed Caribbean alga, reported from Bermuda and Florida to Brazil. It is found on rocks, shells, and corals, in quite shallow water, often forming closely entangled masses. It may descend to water of moderate depths.

PANAMA: Dredged from 2-13 meters off a bottom of mud and fine sand at sta. A2 near Caledonia Harbor, no. 39-214, 3 April 1939; Caledonia Harbor, abundant along the shore on rocks in shallow water near Isla Piedra and I. San Augustin, no. 39-224a, 4 April 1939. NETHERLANDS WEST INDIES: Aruba Island, sparse on rocks along the shore of the cove at Punta Basora, no. 39-319, 10 April 1939. VENEZUELA: Tortuga Island, occasional as washed ashore on Punta Arenas, no. 39-399, 13 April 1939; Cubagua Island, infrequent on rocks scattered along the shore, no. 39-460, 14 April 1939. BRITISH WEST INDIES: Trinidad Island, dredged from 2-5 meters' depth at sta. A35 off a bottom of sand and other algae, no. 39-488, 18 April 1939.

### ***Dictyota ciliolata* Kützting**

Vickers 1908, p. 39, pl. 17 (as *D. ciliata*); Taylor 1928, p. 119, pl. 17, fig. 1.

An alga fairly frequent from moderately shallow water in the Caribbean, growing on stones, shells, and old corals. It has been reported from Bermuda and Florida to Brazil. When, as often happens, the marginal teeth or cilia are very rare, only general features of form are available to distinguish this plant from *D. dichotoma*.

PANAMA: Caledonia Harbor, frequent in shallow water, and variable in aspect, both narrow and wide forms being present; from near

Isla Piedra and I. San Augustin, *no.* 39-187, 3 April 1939, and *no.* 39-222, 4 April 1939. VENEZUELA: Frequent as washed ashore on the beach at Punta Arenas, *no.* 39-402, 13 April 1939. BRITISH WEST INDIES: Tobago Island, rather common, the plants often with margins nearly smooth, Buccoo Bay, *nos.* 39-402, 39-512a, 13 May 1939.

### *Dictyota dentata* Lamouroux

Vickers 1908, p. 38, II pl. 14 and p. 38, II pl. 15 (as *D. Mertensii*); Taylor 1928, p. 119, pl. 16, figs. 4, 5.

A common and beautiful species of the Caribbean region, reported from Bermuda and Florida to Brazil. It grows in water of quite moderate depth on corals, shells, and rocks, and is often quite iridescent.

PANAMA: Caledonia Harbor, frequent on the rocks in shallow water near Isla Piedra and I. San Augustin, *nos.* 39-164, 39-165, 3 April 1939. NETHERLANDS WEST INDIES: Aruba Island, small but common on the rocks along the shore of the cove at Punta Basora, *no.* 39-317, 10 April 1939; Curaçao Island, small plants, but common on the rocks along the shore, Jan Thiel Beach, *no.* 39-592, 23 April 1939. VENEZUELA: Infrequent as washed ashore on the beach at Punta Arenas, *no.* 39-401, 13 April 1939. BRITISH WEST INDIES: Tobago Island, rare specimens washed ashore in Rockly Bay, *no.* 39-502, 18-20 April 1939.

### DICTYOPTERIS Lamouroux, 1809

Plants small to large and coarse, sometimes entangled, generally erect and bushy, the segments flat, membranous, costate, dichotomously to alternately branched, forming the reproductive cells in linear or rounded sori on either side of the blade.

#### KEY TO SPECIES

1. Thallus very thin, translucent . . . . . 2
1. Thallus thick, dark brown, over 1 cm. wide . . . . . *D. Justii*
2. Thallus showing delicate veins running from the midrib toward the margin of the blade . . . . . *D. plagiogramma*
2. Thallus without veins between midrib and margin . . . . . *D. delicatula*

### *Dictyopteris Justii* Lamouroux

Vickers 1908, p. 36, II pl. 5; Taylor 1928, p. 121, pl. 17, fig. 5 (as *Neurocarpus Justii*).<sup>2</sup>

<sup>2</sup> *Dictyopteris* Lamouroux 1809 is conserved over *Neurocarpus* Weber and Mohr 1805 by Internat. Rules Bot. Nomencl., *cfr.* Briquet 1935, pp. 86, 119.



A large and coarse species, commonly found in rather shallow water on broken corals or rocks, but descending to 11 meters in Florida. It shows considerable range in width of blade and coarseness, but is always far thicker than any of the other species of the genus, and in aspect is not unlike some kinds of *Fucus*. It is not as commonly reported as the widespread *D. delicatula*, but ranges as widely in the American area.

NETHERLANDS WEST INDIES: Fragments, particularly delicate in texture, dredged from 43 meters' depth off a bottom of sand and coralline algae at sta. A18 near Aruba Island, no. 39-357, 10 April 1939. VENEZUELA: Tortuga Island, infrequent as washed ashore on the beach at Punta Arenas, no. 39-367, 13 April 1939. BRITISH WEST INDIES: Tobago Island, frequent and luxuriant as washed ashore in Buccoo Bay, no. 39-523, 20 April 1939.

#### *Dictyopteris delicatula* Lamouroux

Vickers 1908, p. 35, II pl. 3; Børgesen 1914, p. 216, figs. 166, 167; Taylor 1928, p. 121, pl. 17, fig. 7, pl. 19, fig. 6 (as *Neurocarpus delicatulus*).

A common plant of tropical waters, generally entangled in small amounts among other algae and then inconspicuous, but sometimes forming considerable masses by itself. It grows chiefly in shallow water and rather sheltered places. Within our area it has been reported from many stations between Bermuda and Brazil.

PANAMA: Caledonia Harbor, infrequent, but forming tufts on corals in deep tide pools near Isla Piedra and I. San Augustin, no. 39-242, 4 April 1939. NETHERLANDS WEST INDIES: Aruba Island, occasional tufts in shallow water along the shore of the cove at Punta Basora, no. 39-322, 10 April 1939. VENEZUELA: Abundant tufts washed ashore on the beach, Punta Arenas, no. 39-366, 13 April 1939. BRITISH WEST INDIES: Tobago Island, scattered pieces of material, Buccoo Bay, no. 39-514, 20 April 1939.

#### *Dictyopteris plagiogramma* (Montagne) Vickers

Vickers 1908, p. 36, II pl. 4; Taylor 1928, p. 122, pl. 17, fig. 8, pl. 19, fig. 8, pl. 28, fig. 3 (as *Neurocarpus plagiogrammus*).

A much larger, more erect species than *D. delicatula*, with such unequal forking that the plant appears alternately to unilaterally branched at times. It appears to be a plant of rather deep water; in Florida it was dredged to 18 meters. It has not been reported very often, but ranges from Bermuda to Brazil, and perhaps in the western Pacific.

NETHERLANDS WEST INDIES: Rare as dredged from 43 meters' depth off a bottom of sand and coralline algae at sta. A18 near Aruba Island, no. 39-361, 10 April 1939. VENEZUELA: Tortuga Island, frequent as washed ashore in excellent condition on the beach at Punta Arenas, no. 39-409, 13 April 1939.

## Fucaceae

Moderate to very large plants, somewhat delicate to massive, sub-parenchymatous in structure, forming a large cushionlike or fibrous holdfast from which arise one or more main axes which may be cylindrical, subsimple or more generally branched, or flat, frequently winged, with a broad membranous marginal blade, and in some genera divided into a stem with leaflike organs laterally placed on it. Reproduction by the formation of fertile crypts or conceptacles generally over the plant body or, in the more specialized genera, in special receptacular branchlets; heterosporous, eventually producing gametes by continuing the divisions in the sporogenous organs.

### KEY TO GENERA

1. Leaves flat, linear to ovate, entire to serrate, with a midrib  
 . . . . . Sargassum
1. Leaves obconical, the flat end often membranous around the  
 margin and serrate, the pedicel often ridged longitudinally  
 and sometimes serrate . . . . . Turbinaria

### SARGASSUM C. Agardh, 1821

Plants of moderate to large size, with distinct often massive lobed holdfast and well-differentiated branches with broad to filiform, occasionally forked, entire or serrate leaf organs; lateral stalked bladders usually present; receptacles axillary or paniculate, more or less forked, cylindrical, nodulose, sometimes flattened and serrate; eventually bearing eggs singly in the megasporangia.

### KEY TO SPECIES

1. Pelagic species without haptera; sterile; cryptostomata absent  
 or inconspicuous . . . . . *S. fluitans*
1. Attached species, only secondarily detached and found float-  
 ing; fertile in season, cryptostomata generally present . . . 2

2. Leaves narrow, usually 7-50 times as long as broad . . . 3
2. Leaves ovate to linear-oblong, usually less than 7 times as long as broad . . . . . 6
3. Leaves entire to slightly serrate above; cryptostomata very small and scattered; leaves of old plants when dried often with a whitish bloom; receptacles loosely branched, branches slender . . . . . *S. cymosum*
3. Leaves generally strongly serrate . . . . . 4
4. Midrib of older leaves unilaterally prominent, becoming crested, serrate; vesicles large . . . . . *S. pteropleuron*
4. Midrib not becoming prominent or serrate . . . . . 5
5. Leaves thin, linear-lanceolate, tips short-tapered to blunt, cryptostomata scattered and usually rather small . . . *S. Filipendula*  
     Leaves narrowly linear, nearly entire, receptacles several centimeters long and very loosely branched . var. *Montagnei*
5. Leaves firmer, tapering from the middle to base and apex, coarsely toothed to subentire, cryptostomata rather obvious, in a single row on each side of the midrib . . . . . *S. linifolium*
6. Leaves with very large cryptostomata (to 0.5-0.9 mm. diam.) in a single row on each side of the midrib; receptacles with serrate margins . . . . . *S. platycarpum*
6. Leaves with relatively inconspicuous cryptostomata . . . 7
7. Leaves narrower, usually 4-8 times as long as broad, serrate dentate; stem smooth . . . . . *S. vulgare*  
     Leaves densely crowded, small, broad and obtuse, with the teeth more obtuse . . . . . var. *foliosissimum*
7. Leaves wider, usually 2-4 times as long as broad, acuminate-dentate, commonly crisped; stem commonly minutely muriculate . . . . . *S. polyceratum*

#### *Sargassum fluitans* Børgesen

Børgesen 1914, p. 66; Taylor 1928, p. 127, pl. 18, fig. 9, pl. 19, fig. 5; 1937, p. 211.

Known from Bermuda to British Honduras as a pelagic species which accompanies *S. natans*, or often replaces it as the characteristic weed of the Gulf Stream, by which it may reach Massachusetts and other northern shores after storms.

PANAMA: Caledonia Harbor, floating near Isla Piedra and I. San Augustin, no. 39-247b, 4 April 1939.

***Sargassum cymosum* C. Agardh**

This species has been recorded from Bermuda to Brazil, and probably grows in water of moderate depth. However, it is seemingly more common in the southern part of its American range.

BRITISH WEST INDIES: Trinidad Island, dredged from 2-5 meters' depth on a bottom of sand and other algae at sta. A35 near Port-of-Spain, no. 39-487, 18 April 1939.

***Sargassum pteropleuron* Grunow**

Grunow 1867, p. 55, pl. 5, fig. 1; J. Agardh 1889, p. 107; Taylor 1928, p. 130, pl. 18, fig. 6, pl. 19, fig. 15.

This species has not been often reported; when young or ill developed, in the absence of the crests on the midribs, it is not easy to distinguish from *S. Filipendula* and other species. It appears to be a form of moderately deep water, having been dredged attached from a depth of 3 meters and more, but is generally found washed ashore. It has been reported from Bermuda to Dominica.

VENEZUELA: Cubagua Island, drifted ashore on a sandy beach, no. 39-440, 14 April 1939.

***Sargassum Filipendula* C. Agardh**

Taylor 1928, p. 127, pl. 18, fig. 5, pl. 19, fig. 17; 1937, p. 210, pl. 27, figs. 4-6.

A common species ranging from its extreme northern limit in southern Massachusetts through the warm temperate and tropical region to Brazil. It grows on stones and shells, most commonly a little below low-tide level, but has been dredged from more than 30 meters' depth.

COLOMBIA: Cienaga, collected as drifting weed, nos. 39-247, 39-248, 7 April 1939; Cape LaVela, taken as driftweed 18 miles off shore, no. 39-253, 7 April 1939; dredged from 9 meters' depth in great abundance at sta. A12a near Cape LaVela, no. 39-255, 8 April 1939; dredged from 24 meters' depth off a bottom of gray sand at sta. A13 near Cape LaVela, no. 39-268, 8 April 1939; dredged, probably from 16-18 meters' depth off a bottom characterized by coralline algae at sta. A15 near Bahia Honda, no. 39-278, 8 April 1939. VENEZUELA: Cubagua Island, frequent, attached to rocks in shallow water, no. 39-475a, 14 April 1939; Tortuga Island, abundant on rocks in shallow water on Punta Arenas, no. 39-364, 13 April 1939.

var. *Montagnei* (Bailey) Collins and Hervey

A form infrequently reported, but known from the northern part of the range of the species and from Bermuda. The specimen recorded agreed with the variety in general, but did not show the extreme phase of the reduction of the teeth on the leaves, or the extreme looseness of the receptacles.

COLOMBIA: Abundant, taken as driftweed 18 miles off Cape LaVela, no. 39-252, 7 April 1939.

*Sargassum linifolium* (Turner) C. Agardh

Kützing 1861, pl. 24; Collins & Hervey 1917, p. 81.

Previously reported, in American waters, only from Bermuda. The plants from Venezuela showed rather more strongly serrate leaves than those in the Phycotheca Boreali-Americana from Bermuda, but in form differed markedly from *S. lendigerum*, and in form and cryptostomatal arrangement as well differed from *S. Filipendula*.

VENEZUELA: Tortuga Island, abundant on rocks in shallow water on Punta Arenas, no. 39-364b, 13 April 1939.

*Sargassum platycarpum* Montagne

J. Agardh 1889, p. 89, pl. 6; Vickers 1908, p. 35, II pl. 1.

Widely distributed in the American tropics, extending from Bermuda to Brazil, and frequently reported. This is a plant which grows attached to stones or shells in quite shallow water.

NETHERLANDS WEST INDIES: Aruba Island, abundant in shallow tide pools toward the southern end of the cove at Punta Basora, no. 39-305, 10 April 1939.

*Sargassum vulgare* C. Agardh

J. Agardh 1889, p. 108; Børgesen 1914, p. 62, fig. 169; Taylor 1928, p. 130, pl. 18, fig. 11, pl. 19, fig. 12.

This species appears to grow on rocks in relatively shallow water, but in one form or another has been dredged to considerable depths. It is recorded as ranging from Bermuda to Brazil, but individual earlier records are subject to question, since the name has often been uncritically applied.

VENEZUELA: Tortuga Island, abundant on rocks in shallow water along the sandy beach, Punta Arenas, no. 39-363, 13 April 1939; dredged at 25.5 meters' depth from a bottom of sand and algae at sta. A25 near



Cubagua Island, *no.* 39-476, 14 April 1939. BRITISH WEST INDIES: Tobago Island, commonly washed ashore at Rockly Bay, *no.* 39-501a, 18-20 April 1939; on coral rock in shallow water near the shore, Buccoo Bay, *no.* 39-511a, 20 April 1939.

var. *foliosissimum* (Lamouroux) J. Agardh

NETHERLANDS WEST INDIES: Aruba Island, very abundant toward the north end of the cove on the tops of flat rocks, exposed by the receding tide, Punta Basora, *no.* 39-325, 10 April 1939; Curaçao Island, very common on the massive broken corals along the shore, Jan Thiel Beach, *no.* 39-611, 23 April 1939.

### *Sargassum polyceratum* Montagne

Taylor 1928, p. 129, pl. 18, fig. 12, pl. 19, fig. 14.

Reported frequently from the American tropics, its range extending from Bermuda to Brazil. It occurs in water of very moderate depths, down to 13 meters or somewhat more, on old corals, stones, or shells.

PANAMA: Caledonia Harbor, abundant at a depth of one meter on old corals in pools along shore near Isla Piedra and I. San Augustin, *no.* 39-151, 3 April 1939.

### TURBINARIA Lamouroux, 1828

Plants attached by short branching haptera, sending up one or a few simple or branched axes which bear the leaves. Leaves flat and expanded on the end, round to triangular, the margin nearly entire to coarsely serrate, below tapering downward usually in a pyramidal fashion to the pedicel, the angles entire to winged and serrate; vesicles when present immersed in the leaves near the end. Receptacles crowded into dense clusters between the leaves.

#### KEY TO SPECIES

1. Petiolar wings generally entire, the lamina usually with a vesicle . . . . . *T. turbinata*
1. Petiolar wings dentate, the lamina without a vesicle . . . . . *T. tricostata*

### *Turbinaria turbinata* (Linnaeus) Kuntze

Kützinger 1860, p. 24, pl. 67 (as *T. trialata*, *havanensis*); Barton 1891, p. 218; Børgesen 1914, p. 61, fig. 168 (both as *T. trialata*); Taylor 1928, p. 131, pl. 18, fig. 13.

A common plant of shallow water, growing on rocks and broken corals; in the American tropics its range appears to be from Florida and the Bahamas to Venezuela.

PANAMA: Caledonia Harbor, abundant on old corals at a depth of one meter along the shore near Isla Piedra and I. San Augustin, *no.* 39-152, 3 April 1939. NETHERLANDS WEST INDIES: Aruba Island, not very abundant, on rocks in shallow water in the cove at Punta Basora, *no.* 39-302, 10 April 1939.

### *Turbinaria tricostata* Barton

Barton 1891, p. 218, pl. 54, fig. 3.

Not as common as *T. turbinata*, and perhaps the plants generally smaller. It is reported at a few stations between Bermuda and Guadeloupe. It grows in similar situations.

NETHERLANDS WEST INDIES: Aruba Island, scarce and dwarf, on rocks in shallow water of the cove at Punta Basora, *no.* 39-303, 10 April 1939. Growing with, but entirely distinct from, *T. turbinata*.

**MYXOPHYCEAE<sup>3</sup>****Stigonemataceae****MASTIGOCOLEUS** Lagerheim ex Bornet & Flahault, 1887**Mastigocoleus testarum** Bornet and Flahault

Tilden 1910, p. 237, pl. 14, fig. 12; Taylor 1928, p. 49, pl. 2, fig. 2.

Plants discoloring shells dirty or yellowish green, in shallow salt water, the much-branched filaments growing at the surface of the shells and penetrating the outer layers, the spherical heterocysts borne terminally on short lateral branches.

NETHERLANDS WEST INDIES: Aruba Island, with *Calothrix crustacea* in worn coral fragments in shallow water, cove at Punta Basora, no. 39-340, 10 April 1939.

**Nostocaceae****HORMOTHAMNION** Grunow ex Bornet & Flahault, 1888**Hormothamnion enteromorphoides** Bornet & Flahault

Tilden 1910, p. 205, pl. 10, fig. 13; Taylor 1928, p. 48, pl. 2, fig. 3; Frémy 1939, p. 44, fig. 7.

Plant a bright blue-green, fragile gelatinous stratum on rocks and other algae in shallow salt water, the upper portions free and protruding as irregularly shaped tongues, the trichomes torulose, many within the hyaline gelatinous sheath, the sheath fragile and soon diffluent.

BRITISH WEST INDIES: Tobago Island, abundant on algae and corals near the shore of Buccoo Bay, no. 39-551, 20 April 1939. PANAMA: Caledonia Harbor, on other algae near the southeast end of the harbor, no. 39-188, 3 April 1939.

**Rivulariaceae****CALOTHRIX** C. Agardh ex Bornet & Flahault, 1886**Calothrix crustacea** Bornet and Flahault

Tilden 1910, p. 264, pl. 17, figs. 2-6; Taylor 1928, p. 51, pl. 2, fig. 10; Frémy 1939, p. 35.

Plant a blue-green or brown velvety (becoming pulvinate and gelati-

<sup>3</sup> The section on Myxophyceae has kindly been contributed by Dr. Francis Drouet, Field Museum of Natural History.

nous) stratum on rocks, shells, wood, and old portions of larger plants between or just below tide marks, the young filaments short and upright, the older filaments becoming long, prostrate, interwoven, and branched, the sheaths at first thin and hyaline, becoming much thickened and yellow or brown with age, the heterocysts both basal and scattered among other cells of the trichome.

NETHERLANDS WEST INDIES: Aruba Island, on rocks and worn coral, cove at Punta Basora, nos. 39-339, 39-340, 10 April 1939.

### Scytonemataceae

SCYTONEMA C. Agardh ex Bornet & Flahault, 1887

*Scytonema ocellatum* Bornet and Flahault

Tilden 1910, p. 208, pl. 12, fig. 8.

Plant a brown, black, or verdigris-green velvety or pannose stratum on rocks and trees, commonly found on soil frequently wet by rain water in temperate and tropical America. The filaments are straight or contorted, never adhering together above in fascicles, the sheaths brown or yellow, not ochreate toward the tips.

VENEZUELA: Cubagua Island, on dry mud of a high tide pool near the shore, no. 39-475c, 14 April 1939.

### Oscillatoriaceae

PORPHYROSIPHON Kützing ex Gomont, 1893

*Porphyrosiphon fuscus* Gomont

Frémy 1927, p. 115.

Plant a greenish, brown, or red pannose stratum on soil wet by rain water, often found mixed with other soil algae, the filaments long, interwoven, and often contorted, the sheaths cylindrical, firm, hyaline at first, becoming red, purple, or purple brown in age, the trichomes pale blue green, 3-7  $\mu$  broad, rounded at the tips, not constricted at the cross walls, one (rarely two or more) within the sheath, the cells quadrate and longer than broad.

VENEZUELA: Cubagua Island, with *Scytonema ocellatum* on dry mud of a high rain pool along the shore, no. 39-475c (in part), 14 April 1939.

**SCHIZOTHRIX** Kützing ex Gomont, 1892**Schizothrix** sp.

A soil alga of wide distribution in tropical and temperate America, to be described.

VENEZUELA: Cubagua Island, on dry mud of a high rain pool along the shore, *no. 39-475b*, 14 April 1939.

**Schizothrix fuscescens** Gomont

Gomont 1892, p. 324.

Plant a brown or black pannose stratum on soil or rocks wet by rain water, or mixed with other soil algae, the filaments tenuous, up to 12  $\mu$  broad, much contorted and branched below, adhering together in upright fascicles above, the sheaths at first hyaline, becoming golden or dark brown in age, the trichomes 1-3  $\mu$  broad, one to several within a sheath.

PANAMA: Caledonia Harbor, on soil under cocoanut trees not very near the shore, southeast end of the harbor, *no. 39-619b*, 27 April 1939.

**HYDROCOLEUM** Kützing ex Gomont, 1892**Hydrocoleum comoides** Gomont

Tilden 1910, p. 134, pl. 5, fig. 56.

Plant a tough expanded greenish, brown, or black mat on rocks in quiet salt water, the upper portions floating free as coarse strands and tongues to 1 cm. or more long, the filaments parallel, the trichomes 14-21  $\mu$  broad, the sheaths hyaline, not diffuent except in hormogonial masses.

PANAMA: Caledonia Harbor, from rocky ledges and sandy shallows near the southeast end, *no. 39-243*, 4 April 1939.

**MICROCOLEUS** Desmaziers ex Gomont, 1892**Microcoleus chthonoplastes** Gomont

Tilden 1910, p. 155, pl. 6, fig. 28; Frémy 1939, p. 16.

Plant a pannose blue-green, black, or brown stratum on ground wet by salt water, or a radiately fibrous mass submersed in brackish or semi-marine locations; the filaments coarse, each containing many trichomes, straight, parallel, branched, the common sheath hyaline and firm, the trichomes straight, constricted at the cross walls, 2-6  $\mu$  broad, the cells longer than broad, the end cells long-conical, their outer membranes not thickened.

NETHERLANDS WEST INDIES: Aruba Island, with *Lyngbya aestuarii* forming a coating on calcareous sand behind the barrier beach, cove at



Punta Basora, no. 39-301, 10 April 1939. PANAMA: Caledonia Harbor, with *Lyngbya aestuarii* near the southeast end, no. 39-244, 4 April 1939.

**PLECTONEMA** Thuret ex Gomont, 1892

**Plectonema terebrans** Gomont

Tilden 1910, p. 209, pl. 11, fig. 6.

Plant a thin blue-green and brownish stratum on shells, the lower portions penetrating the matrix of the shells, the filaments straight or curved, branched, much interwoven, the sheaths hyaline, thin, coloring blue when treated with chlor-zinc-iodine, the trichome 1-2  $\mu$  broad, not constricted at the cross walls, rounded at the tips, the cells quadrate and longer than broad.

NETHERLANDS WEST INDIES: Curaçao Island, in old corals along Jan Thiel Beach, no. 39-615, 23 April 1939.

**SYMPLOCA** Kützing ex Gomont, 1892

**Symploca hydroides** Gomont

Tilden 1910, p. 129; Frémy 1939, p. 22.

Plant a black, blue-green, or violet slimy or gelatinous-pannose stratum on rocks or other algae between or just below tide marks, the lower filaments straight or flexuose, parallel or much intertwined, the upper filaments parallel and agglutinated into fascicles up to 5 cm. long, the sheaths hyaline, thin, firm or diffuent, coloring blue when treated with chlor-zinc-iodine, the trichomes 6-12  $\mu$  broad, slightly constricted at the cross walls, rounded at the tips, the cells quadrate and longer or shorter than broad.

BRITISH WEST INDIES: Tobago Island, on Buccoo Reef, no. 39-548, 20 April 1939.

**LYNGBYA** C. Agardh ex Gomont, 1892

**Lyngbya aestuarii** Gomont

Tilden 1910, p. 120, pl. 5, figs. 40, 41; Frémy 1939, p. 27.

Plant a pannose, green, blue-green, black, or brownish stratum on soil wet by salt or rain water, or a coarsely and radiately fibrous mat submersed in fresh or salt water, the filaments coarse, straight and entangled, the sheaths hyaline and thin at first, becoming thick, lamellose, and internally yellow, brown, or almost black, never coloring blue when treated with chlor-zinc-iodine, the trichomes 10-40  $\mu$  broad, cylindrical, not con-

stricted at the cross walls, slightly attenuated at the tips, the cells very short, the cross walls marked on each side with a row of conspicuous granules, the apical cell rounded-truncate, the outer membrane conspicuously thickened.

NETHERLANDS WEST INDIES: Aruba Island, forming a coating on calcareous sand behind the barrier beach, cove at Punta Basora, *no.* 30-301; *idem*, in high tide pools, *no.* 39-332, 10 April 1939. PANAMA: Caledonia Harbor, near the southeast end, *no.* 39-244, 4 April 1939.

### ***Lyngbya majuscula* Gomont**

Tilden 1910, p. 123, pl. 5, fig. 42; Taylor 1928, p. 44, pl. 1, fig. 19; Frémy 1939, p. 29.

Plant a greenish, brown, or black mat of coarse tangled threads free in salt water, or entangled with attached algae, less often forming a fibrous-pannose stratum on rocks, the filaments contorted and much intertwined, not seldom straight and parallel, the sheaths hyaline, at first thin, becoming thickened, roughened, and lamellate in age, never coloring blue when treated with chlor-zinc-iodine, the trichome 15-60  $\mu$  broad, not constricted at the cross walls, the cells very short, the cross walls not granulated, the apical cells rounded.

BRITISH WEST INDIES: Tobago Island, on sandy bottom near Buccoo Reef, *no.* 39-550, 20 April 1939.

### **PHORMIDIUM Kützling ex Gomont, 1892**

#### ***Phormidium Crosbyanum* Tilden**

Tilden 1910, p. 96, pl. 4, figs. 60, 61.

Plant a blue-green, blackish, brown, or red firm gelatinous stratum on rocks, corals, and larger plants in shallow marine situations, the filaments much interwoven, flexuose, not fragile, the gelatinous material hyaline, usually evident as a distinct sheath about each trichome but wholly diffuent in older masses, coloring bright blue when treated with chlor-zinc-iodine, the trichomes pale blue green or rose colored, 1-3  $\mu$  broad, not at all or only slightly constricted at the cross walls, shrunk in drying, the cells quadrate and longer than broad, the end cells rounded. Howe described material of this species from Cuba under the name *P. Hendersonii*.

BRITISH WEST INDIES: Tobago Island, on larger algae in the tide pools of Buccoo Reef, *nos.* 39-517, 39-547, 20 April 1939. PANAMA: Caledonia Harbor, on corals in high, hot tide pools, southeast end of the harbor, *no.* 39-241, 4 April 1939.

## RHODOPHYCEAE

### Bangiaceae

Plants filamentous, the filaments simple or branched, or creeping and associated to form disks, or membranous; cells usually with axial, sometimes parietal chromatophores; asexual reproduction by monospores; sexual reproduction when present by spermatia and carpogonia, the zygote developing several carpospores.

#### KEY TO GENERA

1. Plant creeping or endophytic . . . . . *Erythrocladia*
1. Plant erect, filamentous or strap shaped . . . . . 2
2. Filaments branched . . . . . *Goniotrichum*
2. Filaments simple, cylindrical, or strap shaped . . . *Erythrotrichia*

#### ERYTHROCLADIA Rosenvinge, 1909

##### KEY TO SPECIES

1. Branches separate, the plant spreading and not disciform, the spores conspicuous . . . . . *E. pinnata*
1. Branches approximate, the plant disciform, with inconspicuous spores . . . . . *E. subintegra*

#### *Erythrocladia subintegra* Rosenvinge

Plate 1, Fig. 1

Plants with radial filaments laterally approximated to form small epiphytic disks, the filaments branching by a forking of the apical cell (marginal to the disk), one or the other of the arms being cut off by a transverse wall; cells 4-6  $\mu$  diam.; cell arrangement toward the center of the disk becoming irregular; reproduction by monospores from the older cells.

Børgesen 1915-20, p. 7, figs. 3, 4; Taylor 1930, p. 635, fig. 1.

Not frequently reported, but known from a few stations between Bermuda, Florida, and Brazil. This small plant seems chiefly to come with hosts which derive from relatively shallow water. It may be found on sertularians as well as on plants.

COLOMBIA: Dredged from 14-16 meters' depth off a bottom of coralline algae, epiphytic on a coarser Rhodophycean alga, sta. A15 near Bahia Honda, no. 39-290, 8 April 1939. BRITISH WEST INDIES: Tobago

Island, occasional on the cell wall of old specimens of *Bryopsis* washed ashore in Rockly Bay, no. 39-492, 19 April 1939.

***Erythrocladia pinnata* n. sp.<sup>4</sup>**

Plate 2, Figs. 1, 2

Plant creeping between the layers of the host coenocyte membrane, freely branched, in the older portions crowded, the first branches formed alternately or less often unilaterally, but later opposite branches often formed on the same axis cells; branches formed near the upper end of the supporting cell, or near the middle, very soon isolated by a transverse wall, little more slender toward the ends than in the older axes; filaments 2.0-3.8  $\mu$  diam., cells 2-4 diameters long, cylindrical or slightly swollen in the middle and a little rounded at the ends; chromatophores and pyrenoids obscure; monosporangia mostly on the old and crowded parts of the plant, sessile or terminating short 1-3-celled branches, on the side or near the end of the supporting cell, protruding through the host membrane, subspherical, 4.5-5.5  $\mu$  in diameter.

BRITISH WEST INDIES: Tobago Island, abundant on old stalks of denuded *Bryopsis* washed ashore in Rockly Bay, no. 39-492 (in part), 19 April 1939.

This plant is superficially similar to *Acrochaetium Liagorae* Børgesen (1915, p. 58), but the branching is much more ample and regular, and the cells of the filaments less than half the dimensions of that species. The spores are subspherical rather than slightly elongate at maturity, and a third the size of those of *A. Liagorae*. It is also very similar to the plant described by Howe and Hoyt (Hoyt 1920, p. 467) as *Erythrocladia vagabunda*, but is very much smaller in all its parts. The method of branch formation is like that found in the genus *Erythrocladia*, but the spores are much more distinctive than usual in size, though probably similar in origin.

**GONIOTRICHUM Kützinger, 1843**

***Goniotrichum Alsidii* (Zanardini) Howe**

Plant forming rosy tufts, to 0.3-6.0 mm. tall, frequently appearing only as scattered filaments; filaments branching pseudodichotomously,

<sup>4</sup> *Erythrocladia pinnata* n. sp.—Planta intra membranam hospitis serpens, copiose ramosa, ramis alternis aut oppositis; cellulis 2.0-3.8  $\mu$  diam., 2-4-plo longioribus quam latis, cylindricis aut media in parte inflatis; monosporangiis sessilibus aut in ramulis 1-3-cellularibus sitis, subsphaericis, 4.5-5.5  $\mu$  diam., per membranam hospitis eminentibus. Planta typica in loco dicto Tobago Island, British West Indies, no. 39-492, 19 April 1939.

12-20  $\mu$  diam., sometimes more at the base; cells uniseriate, rarely pluriseriate in the branches, depressed spherical to ellipsoid, 7-13  $\mu$  diam., 4-13  $\mu$  long; chromatophores stellate, violet red, sometimes somewhat greenish; reproduction by monospores produced from the upper cells and released by dissolution of the thallus.

Taylor 1937, p. 215, pl. 28, figs. 1-4.

An inconspicuous epiphyte, particularly upon *Thalassia* in shallow, quiet water. It is also found in temperate waters, and within our area from Bermuda and North Carolina to Barbados.

BRITISH WEST INDIES: Tobago Island, a minor associate of other minute species on *Thalassia* leaves, Buccoo Bay, no. 39-557c, 20 April 1939.

### ERYTHROTRICHIA Areschoug, 1850

Plant erect, the base small, multicellular and disciform, or of a few rhizoidal cells, or simply of the expanded end of the basal cell; major portion of the plant erect, filamentous, generally uniseriate, sometimes pluriseriate or strap shaped and monostromatic; monosporangia segregated from vegetative cells by oblique walls; spermatangia formed by subdivision of previously vegetative cells; carpogonia formed by direct transformation of vegetative cells; cystocarps of a few carpospores.

#### KEY TO SPECIES

1. Plant with a unicellular lobed base; erect filament uniseriate or with a few longitudinal walls . . . . . *E. carnea*
1. Plant with a base formed by rhizoidal extensions from several cells; erect portion at first uniseriate, later from pluriseriate becoming broadly monostromatic . . . . . *E. vexillaris*

#### *Erythrotrichia carnea* (Dillwyn) J. Agardh

Taylor 1928, p. 133, pl. 20, figs. 4, 5; 1937, p. 217, pl. 28, figs. 13-15.

An epiphytic plant of very wide distribution, perhaps chiefly in temperate regions. It generally grows in shallow water. In the American tropical Atlantic the few reports have ranged from North Carolina and Bermuda to Venezuela.

NETHERLANDS WEST INDIES: Curaçao Island, growing on *Acanthophora* and among other small algae on rocks along the shore of Valentijn's Bai, Willemstad, coll. F. H. Elmore, nos. 39-572, 39-581 in part, 23 April 1939.



***Erythrotrichia vexillaris* (Montagne) Hamel**

Plate 1, Figs. 2-11

Plant at an early stage consisting of a simple filament a few cells in length, with the basal cell extended to an attenuate holdfast; later the lower cells of the filament send colorless prolongations down through the lateral membrane to contribute to the anchorage of the plant. The erect filament begins to develop longitudinal walls when about 10 cells long, the upper part of it becomes biseriate, and gradually widens to form a monostromatic blade in which the cells retain more or less distinctly an arrangement in longitudinal and transverse rows one or two cells wide. The shape of the blade at first is filiform, later becoming oblong with a uniseriate and somewhat tapered base, but ultimately the base may become broadly rounded. Growth is at first terminal or at least subterminal, but in older blades it is probably low intercalary above the holdfast region. No reproduction was clearly recognized in the material, but monospores are reported. Width of the cells varies with the age of the plant and the recentness of division, before division being about 13-15  $\mu$ , after division 7.5-10.0  $\mu$ . The chromatophores were not clear in the dried material, but apparently were stellate. The blade never becomes more than one cell thick, and measured about 20  $\mu$ , the individual protoplasts some 12  $\mu$ . In width blades reached about 24 cells, or over 185  $\mu$ , and in length to over 675  $\mu$ .

Hamel 1929, p. 54, figs. A-I.

This plant has been very little known, and the previous descriptions are not complete. It is apparently always an epiphyte, and so far as known restricted to *Grateloupia*. It has previously been reported from Guadeloupe and Martinique. Gardner (1927, p. 237, pl. 24, figs. 4, 5) describes *E. porphyroides* as flat, but having a single basal cell with long lobes.

VENEZUELA: Tortuga Island, epiphytic on *Grateloupia* washed ashore on Punta Arenas, no. 39-379b, 13 April 1939.

**Chantransiaceae**

Plants small, filamentous, with apical growth, the axes prostrate or erect; cell arrangement uniseriate, the cells uninucleate, with one to several chromatophores; asexual reproduction by mono-, bi-, or tetrasporangia; sexual reproduction when present by spermatangia on small, branched spermatangial filaments and by carpogonia terminating carpogenic branches of one to three cells, the cystocarps small.

## KEY TO GENERA

1. Plants generally producing monospores, the cells with one to very few chromatophores . . . . . *Acrochaetium*
1. Plants producing tetrasporangia; cells with many small chromatophores . . . . . *Rhodochorton*

**ACROCHAETIUM** Nägeli, 1861***Acrochaetium antillarum* n. sp.<sup>5</sup>**

Plate 2, Figs. 3, 4

Plant mostly creeping between the layers of the host coenocyte membrane, freely irregularly alternately or seldom subdichotomously branched, the branches successively somewhat more slender toward the tips; forming short, erect filaments projecting beyond the host membrane; in the creeping portion the cells irregular in form, in older parts or occasionally throughout sterile parts isodiametric, quadrate to subspherical or nearly diamond shaped, more generally subcylindrical with ends slightly rounded, 4.5-5.2  $\mu$  diam., 8-15  $\mu$  long, becoming irregularly curved or laterally distended; chromatophores probably axial, showing a prominent pyrenoid in the larger cells; sterile erect filaments very short, simple or very sparingly alternately branched, the cells more thick walled than below, more regularly cylindrical, 4.0-5.7  $\mu$  diam., 5.7-8.0, occasionally to 12.6  $\mu$  long; monosporangium-bearing filaments similar, with 1-4 subcorymbiform branches bearing terminal oval sporangia which are about 7.5-8.5  $\mu$  diam., 10.5-12.5  $\mu$  long.

BRITISH WEST INDIES: Tobago Island, frequent on old stalks of denuded *Bryopsis* washed ashore in Rockly Bay, no. 39-492 (in part), 19 April 1939.

The creeping portion of this plant is like the form of *A. repens* described by Børjesen (1920, p. 453) as growing on *Griffithsia*, but the erect filaments are much less developed and do not develop hairs. It is somewhat like *A. emergens* (Rosenvinge 1909-31, p. 128) in the vegetative filaments, though larger and more moniliform, but the erect spore-bearing filaments are much more developed. Likewise with an endophytic

<sup>5</sup> *Acrochaetium antillarum* n. sp.—Planta intra membranam hospitis serpens, irregulariter aut subdichotome ramosa, filamentis brevibus erectisque ultra superficiem hospitis extensis praedita; filamentis serpentibus cellulas a cylindricis usque ad interdum subsphaericas variantes, 4.5-5.2  $\mu$  diam., 8-15  $\mu$  long. habentibus; filamentis erectis simplicibus aut 1-4 ramos ferentibus, cellulas cylindricas 4.0-5.7  $\mu$  diam., 5.7-8.0  $\mu$  long. habentibus; monosporangiis in ramulis unicellularibus sitis, ovatis, 7.5-8.5  $\mu$  diam., 10.5-12.5  $\mu$  long. Planta typica in loco dicto Tobago Island, British West Indies, no. 39-492, 19 April 1939.

creeping portion, it resembles *Rhodochorton vagum* (Drew 1928, p. 188), but the cells are more slender in the West Indian plant, with short erect branches bearing a few spores, but these again are much smaller. There is much similarity in size and general characters to *A. infestans* Howe and Hoyt (Hoyt 1920, p. 473), but in that species the cells in the host tend to be very long (3-18 times the width) and the spores more often tend to be terminal at the surface of the animal host.

### RHODOCHORTON Nägeli, 1861

#### *Rhodochorton membranaceum* Magnus

Plant filamentous, the uniseriate primary filaments growing between the membranes of the host, 6-10  $\mu$  diam., the cells irregular, 1.5-8.0 diameters long, containing a few short band-shaped chromatophores; erect filaments penetrating above the surface, a few cells in length, simple or sparingly branched; terminal cell of erect branches at last converted into a tetrapartite sporangium about 17-30  $\mu$  long, 12-20  $\mu$  diam.

Taylor 1937, p. 240, pl. 31, figs. 11-12.

COLOMBIA: Dredged from 14-16 meters' depth off a bottom of coral-line algae upon which grew the sertularians containing the *Rhodochorton*, sta. A15 near Bahia Honda, no. 39-293, 8 April 1939.

### Helminthocladiaceae

Plants of moderate size, erect and coarsely branched, mucous, sometimes calcified; structurally generally multiaxial, the ultimate branchlets turning outward to form the assimilatory cortex; monosporangia sometimes present; spermatangia borne on the ends of the assimilatory filaments; carpogenic branches also borne on the assimilators, generally near their bases, and composed of three cells; after fertilization the carpospores produced from the carpogonium without development of a pericarp, and upon germination, the carpospores give rise directly to the sexual plant.

### LIAGORA Lamouroux, 1812

#### KEY TO SPECIES

1. Branching dichotomous or irregular; assimilatory filaments more or less moniliform; dioecious . . . . . 2

1. Branching predominately alternate; assimilatory filaments not moniliform, 17  $\mu$  diam. or more; monoecious; spermatangial clusters usually more than 25  $\mu$  diam.; cystocarps involucrate . . . . . *L. pinnata*
2. Plant in the older parts firmly calcified, the calcification tending to crack off when the plants are dried; assimilatory filaments moniliform toward the tips, reaching 11, rarely 15  $\mu$  diam.; cystocarps with poorly developed involucre . . . *L. valida*
2. Plant moderately calcified; assimilatory filaments to 11  $\mu$  diam.; cystocarps with well-developed involucre . . . *L. ceranoides*

***Liagora valida* (Forsskål) C. Agardh**

Harvey 1853, p. 138, pl. 31, fig. A; Børgesen 1915-20, p. 70, figs. 71-75; Taylor 1928, p. 137, pl. 21, fig. 3, pl. 30, figs. 7, 11.

A widespread tropical marine alga of shallow water, growing on stones and broken corals. It has been reported from Bermuda and Florida to Guadeloupe Island.

PANAMA: Caledonia Harbor, rare on rocks along the shore near Isla Piedra and I. San Augustin, no. 39-193, 3 April 1939.

***Liagora ceranoides* Lamouroux**

Harvey 1853, p. 139, pl. 31, fig. C (as *L. ceranoides*, *L. leprosa*, and *L. pulverulenta*); Børgesen 1915-20, p. 80, figs. 87-92 (as *L. pulverulenta*); Taylor 1928, p. 135, pl. 21, fig. 7, pl. 32, fig. 6, pl. 33, figs. 4, 5.

Plants of rocks and broken corals in shallow water, abundant in the tropics. This species is reported from Bermuda and Florida to Brazil.

PANAMA: Caledonia Harbor, plants scattered over the rocks in shallow water along the shore near Isla Piedra and I. San Augustin, no. 39-226, 4 April 1939. NETHERLANDS WEST INDIES: Curaçao Island, small plants common on the rocks along the shore, Jan Thiel Beach, no. 39-598, 23 April 1939.

***Liagora pinnata* Harvey**

Harvey 1853, p. 138, pl. 31, fig. B; Børgesen 1915-20, p. 74, figs. 76-81; Taylor 1928, p. 136, pl. 21, figs. 1, 6, pl. 30, fig. 1.

This species is generally found in water of moderate depth or near the surface, and in rather exposed situations. It is reported from the Bahamas and Florida to Guadeloupe Island, but not by many collectors.

VENEZUELA: Dredged from 3.5-9.0 meters off a bottom of coral sand and algae at sta. A22 near Tortuga Island, no. 39-425, 13 April 1939.

### Chaetangiaceae

Plants of moderate size, erect and bushy, soft but hardly slippery, sometimes partly calcified; structurally multiaxial, the ultimate branchlets turning outward to form the assimilatory cortex, with the outer cells sometimes closely associated to form a continuous epidermis; monosporangia sometimes present; spermatangia formed on the surface, sometimes in groups; carpogenic branches three-celled, borne on inner forks of the assimilatory cortical filaments; pericarp of slender crowded filaments arising from the lower cell of the carpogenic branch, and eventually forming a pore at the surface.

#### KEY TO GENERA

1. Completely uncalcified, surface smooth . . . . . *Scinaia*
1. Smooth or pilose, but if smooth always more or less calcified . . . . . *Galaxaura*

#### SCINAIA Bivona, 1882

##### *Scinaia complanata* (Collins) Cotton, f.

Plate 12, Fig. 1

Plants to 3-7 cm. tall or more, dichotomously forking at intervals of 4-12 mm., the branches cylindrical, or at the forkings very slightly compressed, 2-4 mm. diam., or slightly more below a fork, very little if at all constricted at the bases of the branches; tips of the branches rounded or obtusely tapered.

Collins 1906, p. 110 (as *S. furcellata* var. *complanata*); Collins and Hervey 1917, p. 101; Setchell 1914, p. 100, pl. 11, figs. 19-22; Børgesen 1915-20, p. 85.

Plants of moderate to quite deep water, growing on shells or other solid objects. This genus is not common in the West Indian region, but the species has, in one form or another, been reported from Bermuda and Florida to (probably) Guadeloupe Island.

NETHERLANDS WEST INDIES: Rare fragments dredged from 43 meters off a bottom of sand and coralline fragments at sta. A18 near Aruba Island, no. 39-353, 10 April 1939. VENEZUELA: Tortuga Island, rare as washed ashore on Punta Arenas, no. 39-390, 13 April 1939. BRITISH WEST INDIES: Tobago Island, rare as washed ashore, Buccoo Bay, no. 39-532, 20 April 1939.

This species of *Scinaia* needs more study. It is worthy of note that Børgesen distinguishes a narrower var. *intermedia* (1915-20, p. 85, figs.



93, 94), which is not flattened and shows a central strand rather conspicuously. On inspection of the writer's *Scinaias* from this general area, he finds that he has forms: (a) with cylindrical branches which are very narrow, 1-2 mm. diam., closely forked and showing no visible axis; (b) branches to about 4 mm. diam., less closely forked, the branches cylindrical except that possibly they are compressed just below a fork; (c) to 1 mm. diam., or 2 mm. below a fork, still less closely branched, the forks to 15 mm. apart, the branches cylindrical except possibly just below a fork, and showing a distinct axis; (d) the condition shown in Phyc. Bor.-Am. 836, with loose branching, definitely flattened branches and no visible axis. This last is presumably type-duplicate material of the species. Small and young plants usually do not show the axis; some of the older ones show only traces of it, although structurally it is of course probably always present, even though not visible in the dried specimen when examined in the ordinary way. The description has been limited to fit the material collected on the present expedition.

#### *Scinaia* sp.

COLOMBIA: Bahia Honda, dredged at 14-16 meters' depth off a bottom of coralline algae at sta. A15, no. 39-291, 8 April 1939.

A fragment of *Scinaia* of exceptional interest was secured at Bahia Honda, and the fact that it was not complete enough to describe is very disappointing. The nature and importance of the piece were recognized in the field, but earnest search failed to produce additional material. The specimen consists of a minute holdfast and stalk, expanding to the first and second dichotomies of the thallus, being altogether 4 cm. tall. In the living state it was evidently quite flat with slightly thickened edges, and the microscopic structure confirmed this as the normal character. At its widest point (not at a fork) the thallus after soaking was barely 6 mm. wide, but it was not possible to get it returned completely to its normal proportions, particularly in thickness. No measurement of the latter therefore is offered, though it is estimated at not over one millimeter. The cystocarps are numerous, almost exclusively marginal, and from the surface appear to reach 175-250  $\mu$  diam. No axial strand is in evidence.

Only one compressed *Scinaia*, *S. complanata* (Collins) Cotton, is known from the Caribbean. While a possible maximum diameter of 6 mm. is suggested (Setchell 1914, p. 100) for this species, it is quite unconfirmed; and, so far as the writer's experience goes, the Florida

specimens of the species are but moderately compressed, and much narrower, with scattered cystocarps. The epidermal utricles in the Colombian plant are closely conjoined, with flat outer faces, forming a continuous epidermis. The utricles are about  $25\ \mu$  tall and  $12\text{--}23\ \mu$  broad in section, in general somewhat taller than broad. In *S. complanata* they are reported considerably broader ( $34\text{--}35\ \mu$ ) than tall ( $22\ \mu$ ), though Setchell's figure 20 (Plate 11) hardly supports this, and the writer examining a specimen of Floridian origin (*Phycotheca Boreali-Americana*) finds them at least  $30\ \mu$  tall, without allowance for evident shrinkage. Perhaps the figure 22 is a misprint for  $32\ \mu$ . The specimen 39-291 then exhibits very considerable differences from described flat species either Atlantic or Pacific, and may presage discovery of an eastern plant as showy as *S. latifrons* of the Pacific.

### GALAXAURA Lamouroux, 1812

Plants bushy, of moderate size, fairly soft to firm and wiry, dichotomously branched; pilose, the cortex inside of the zone of assimilatory filaments somewhat calcified, or, smooth and without free assimilators, lightly to moderately calcified to the surface, in the latter case sometimes segmented by the absence of calcification at the forks; structurally composed of a medulla of slender colorless filaments which gives rise by lateral branches to an inner more or less filamentous cortex of large colorless cells, the outer cortical cells larger and forming a more or less coherent membrane, though in other species these outer cortical cells bear one-celled subspinulose extensions, or even long assimilatory filaments; spermatangia formed in conceptacles; carpogenic branches usually three-celled, formed on the inner cortical filaments, the cystocarp surrounded by a pericarp of slender filaments, discharging by a pore to the surface.

This genus presents peculiar taxonomic difficulty because it is fairly clear that certain species pairs represent, respectively, the sporophyte and the gametophyte phases of the same specific entity. However, since the relationship has been brought out in but a few cases and there are obviously many more needing study, and since the situation has not been experimentally confirmed for any species, the taxonomic readjustments have never been attempted.

### KEY TO SPECIES

1. Thallus with cylindrical branches . . . . . 2
1. Thallus with flat branches . . . . . *G. marginata*

2. Plant without free assimilatory branches, appearing smooth and light, translucent pink . . . . . 3
2. Plant with free assimilatory branches at least on the lower part of the plant, and so pilose and dull red or greenish . *G. squalida*
3. Branches transversely rugose . . . . . *G. rugosa*
3. Branches smooth . . . . . 4
4. Branches 1-2 mm. diam., the segments to 10-15 mm. long; superficial cells 7-27  $\mu$  diam., separating easily after decalcification; moderately calcified . . . . . *G. oblongata*
4. Branches 2-4 mm. diam., the segments relatively short, 5-20 mm. long; superficial cells 24-40  $\mu$  diam., separating with difficulty after decalcification; calcification light . . . *G. obtusata*

### ***Galaxaura squalida* Kjellman**

Kjellman 1900, p. 55, pl. 6, figs. 1-12, pl. 20, fig. 9; Børghesen 1915-20, p. 102, figs. 108-110; Taylor 1928, p. 140, pl. 21, fig. 18, pl. 31, fig. 4.

This species appears to be a common one in the West Indian region. It grows on rocks, corals, and other solid objects in relatively shallow water, and is often discolored by endophytic growths. It has been reported from Bermuda and Florida to Venezuela.

PANAMA: Caledonia Harbor, locally frequent in shallow water on rocks near Isla Piedra and I. San Augustin, *no. 39-203*, 3 April 1939, and *no. 39-223*, 4 April 1939; rare as dredged from 14-25 meters off a bottom of mud and shells at sta. A4 near Caledonia Harbor, *no. 39-217*, 3 April 1939.

### ***Galaxaura rugosa* (Ellis and Solander) Lamouroux**

Kjellman 1900, p. 55; Børghesen 1915-20, p. 100, figs. 105-107; Taylor 1928, p. 140, pl. 21, fig. 16, pl. 30, figs. 2, 10.

A species frequently reported through the whole West Indian region, coming from water of shallow to moderate depth. It ranges from Bermuda and Florida to Brazil.

BRITISH WEST INDIES: Tobago Island, washed ashore on the beach, Rocky Bay, *no. 39-497*, 18-20 April 1939.

### ***Galaxaura oblongata* (Ellis and Solander) Lamouroux**

Børghesen 1915-20, p. 105, fig. 114 (as *G. fragilis*), p. 459; Howe 1920, p. 559; Taylor 1928, p. 139, pl. 21, fig. 15, pl. 31, fig. 5.

A species rather common in tropical American waters, occurring in water of moderate depth on stones, broken corals, etc. It has been reported from Bermuda and Florida to Brazil.

PANAMA: Caledonia Harbor, infrequently secured in shallow water along the shore near Isla Piedra and I. San Augustin, no. 39-204, 3 April 1939.

***Galaxaura obtusata* (Ellis and Solander) Lamouroux**

Kjellman 1900, p. 88; Howe 1920, p. 559; Taylor 1928, p. 139, pl. 21, fig. 11, pl. 31, fig. 2.

An alga rather less frequently found than the preceding; it occurs in somewhat deeper water over the same range. Usually of a translucent pinkish aspect, it is a particularly attractive species, losing most of its beauty on drying.

BRITISH WEST INDIES: Tobago Island, washed ashore on the beach, Rockly Bay, no. 39-498, 18-20 April 1939; common on the beach, Buccoo Bay, no. 39-516, 20 April 1939.

***Galaxaura marginata* (Ellis and Solander) Lamouroux**

Kjellman 1900, p. 77, pl. 20, fig. 44; Børghesen 1915-20, p. 106, figs. 115-117; Taylor 1928, p. 139, pl. 21, fig. 12, pl. 31, fig. 7.

A common marine alga throughout the tropical American area, and widespread elsewhere as well. It is reported from Bermuda and Florida to Brazil, and at many stations. It grows in water shallow or of moderate depth, on stones and broken corals.

PANAMA: Caledonia Harbor, common on rocks in shallow water near Isla Piedra and I. San Augustin, no. 39-201, 3 April 1939. VENEZUELA: Tortuga Island, rare among seaweeds washed ashore on the beach, Punta Arenas, no. 39-391, 13 April 1939. BRITISH WEST INDIES: Tobago Island, common as washed ashore in Rockly Bay, no. 39-399, 18-20 April 1939; rare in Buccoo Bay, no. 39-541, 20 April 1939.

## **Bonnemaisoniaceae**

Plants of moderate size, producing extensive branch systems with an evident axis; structurally showing an axial cell row with short and compact rows extending from it to form the pseudoparenchymatous cortex; sporangia unknown; spermatangia formed on the branchlets in dense masses; carpogenic branches lateral to the cell rows of the cortex, forming a definite pericarp about the cystocarp.

**ASPARAGOPSIS** Montagne, 1840***Asparagopsis taxiformis*** (Delile) Collins and Hervey

Plate 11, Fig. 2

Plants 5-15 cm. tall, with a creeping base bearing descending rhizoidal holdfasts and erect secondary branches which become bushy, above slenderly branched to plumose tips, the subopposite pinnate branches beset with short delicate branchlets; axial cell row in a central cavity, with a few descending filaments, sharply distinct from the pseudoparenchymatous outer cortex; ultimate branchlets near the tip composed of three cell rows without an axial strand.

Collins and Hervey 1917, p. 117; Børgesen 1915-20, p. 352, figs. 347-351.

A rather unusual plant in the West Indian region, although it has been reported from Bermuda to Brazil. It appears to grow in moderately deep water.

VENEZUELA: Tortuga Island, occasional specimens washed ashore on Punta Arenas, no. 39-396, 13 April 1939.

**Gelidiaceae**

Plants small to moderate in size, wiry in texture; axis ultimately of numerous filaments though characteristically with a single cell at the apex; corticated; asexual reproduction by tetrasporangia usually formed just below the surface of the branchlets; sexual reproduction by spermatangia formed from the surface cells, and by carpogenic branches loosely associated with chains of nutritive cells; gonimoblasts mingled with these nutritive cells, and there producing the carpospores.

**KEY TO GENERA**

1. Section of the plant not showing slender filaments mixed with the large cells; tetrasporangia regularly placed in stichidium-like portions of the tips of branchlets . . . . . *Gelidiella*
1. Section of the plant showing very slender filaments mixed with the large cells which make up the bulk of the central tissue; tetrasporangia when young regularly placed in rows near the tips of the branchlets . . . . . *Pterocladia*

**PTEROCLADIA** J. Agardh, 1852

Small plants, to plants of moderate size, generally considerably branched, slender and firm; tetrasporangia formed progressively from



near the apex, in rows; cystocarps with a single loculus, discharging from a pore on one side of fertile branchlet; structurally generally with rhizines in the central part of the stem tissue.

***Pterocladia* sp.**

Plants quite small, forming tufts or turfs, with creeping rhizomes and erect, sparingly branched blades which are flat above.

These represent a dwarf form of a plant which will later be described on the basis of better specimens.

VENEZUELA: Cubagua Island, abundant in close mats near the high-tide line on rocks scattered over the sandy beach, *no.* 39-473, 14 April 1939. BRITISH WEST INDIES: Tobago Island, frequent on rocks of the outer reef, Buccoo Bay, *nos.* 39-554 (in minor part), 39-558c, 20 April 1939.

**GELIDIELLA** Feldmann and Hamel, 1934

***Gelidiella acerosa* (Forsskål) Feldmann and Hamel**

Plant to 5-7 cm. tall, the basal part decumbent and attaching freely, bearing erect secondary branches which are often arcuate, sometimes attached at the tips, and are irregularly and sparingly alternately branched; ultimate main axes cylindrical, or somewhat flattened above, bearing alternate, pinnate, sometimes secund filiform branchlets 2-6 mm. long; texture wiry and tough; tetrasporic plants with the ultimate branchlets irregularly disposed, the fertile ones more or less clavate-swollen with the sporangia low down on the branchlet in a more advanced stage of development than those near the top.

Harvey 1853, p. 169 (as *Ahnfeltia* ? *pinnulata*); Kützting 1868, p. 14, pl. 40, figs. a-d (as *Echinocaulon rigidum*); Børgesen 1915-20, p. 370, fig. 362 (as *Gelidiopsis rigida*); Howe 1920, p. 560; Taylor 1928, p. 143, pl. 22, figs. 8, 9, pl. 23, fig. 4 (both as *Gelidium rigidum*); Feldmann and Hamel 1934, p. 6.

A very common species in most tropical waters, chiefly found in the upper intertidal zone on rocks and broken corals, where exposed to the strong light it is generally of a bright orange-yellow color. It has been frequently reported from our area, and is recorded from Bermuda and Florida to Brazil.

PANAMA: Caledonia Harbor, commonly with the main axes flattened above; abundant on the rocks along the shore near Isla Piedra and I. San Augustin, *nos.* 39-200, 39-202, 3 April 1939. NETHERLANDS WEST

INDIES: Aruba Island, abundant very high on the rocks of the cove at Punta Basora, *no.* 39-333, 10 April 1939. BRITISH WEST INDIES: Tobago Island, a dwarf form abundant on the outer rocks of Buccoo Reef, *nos.* 39-555 (in minor part), 39-558a, 20 April 1939.

### Rhizophyllidaceae

Plants crustose or erect and bushy; structurally with an axis or basal layer of longitudinal (or radial) filaments, supporting a cortex of assimilatory filaments at right angles to the surface, rather closely united into a firm thallus; sporangia tetrapartite, terminal on cortical filaments; spermatangia lateral on short superficial filaments; carpogenic branches together with auxiliary axes in nemathecia, the carpogonium after fertilization first fusing with an intermediate cell in the branch and then sending ooblast filaments to auxiliary cells, which give rise to the crowded cystocarps.

#### CONTARINIA Zanardini, 1843

##### *Contarinia* Magdae Weber-van Bosse?

Thallus closely adherent to the substratum, the lower portion calcified; hypothallus of branching filaments in fan-shaped groups; perithallus of erect dichotomous filaments whose cells decrease in size toward the surface, being about 40  $\mu$  tall below, and 12  $\mu$  tall and wide at the surface; tetrasporangia in sori, formed from the tips of erect filaments, to about 40  $\mu$  long, 20  $\mu$  wide.

Weber-van Bosse in Børgesen 1915-20, p. 128, fig. 137.

The material reported here differs a little from the description given by Mme. Weber-van Bosse. The surface cells were about 10-12  $\mu$  broad, but only 6-10  $\mu$  tall; the sporangia were as large as 42  $\mu$  broad by 73  $\mu$  tall, though usually smaller.

PANAMA: Caledonia Harbor, on old coralline algae in shallow water near Isla Piedra and I. San Augustin, *no.* 39-197 (in part), 3 April 1939. VENEZUELA: Dredged from 38-40 meters off a bottom of dead coral fragments and coralline algae at sta. A44 near Tortuga Island, *no.* 39-560 (in part), 21 April 1939.

### Squamariaceae

Plants spreading, crustose; partly or nearly completely calcified; structurally generally showing a basal layer of radiating filaments sup-

porting a compact upper layer of erect filaments; sporangia tetrapartite, in nemathecial groups or crateriform conceptacles; spermatangia tufted on paraphysal filaments; the short carpogenic branches lateral on similar filaments, the carpogonium fusing after fertilization with an intermediate cell of the branch, from which ooblast filaments radiate to auxiliaries formed at the bases of other paraphyses; gonimoblast masses small.

### PEYSSONNELIA Decaisne, 1841

Carpogenic branches 4-5 celled, the carpogonium fusing with the second cell of the branch after fertilization, and the auxiliary usually the second cell in a lateral axis formed near the base of the paraphysis; gonimoblasts forming 8-12 large carpospores.

#### KEY TO SPECIES

1. Thallus firm, well calcified, dark reddish; with short, high marginal cells (viewed in radial section) . . . *P. polymorpha*
1. Thallus thinner, fragile, calcified below, light pinkish red; marginal cells (viewed in radial section) low and long, only as high as the hypothallic cells . . . . . *P. rubra*

#### *Peyssonnelia polymorpha* (Zanardini) Schmitz?

Weber-van Bosse in Børgesen 1915-20, p. 145, fig. 149.

Attached to old coralline algae in rather deep water. These specimens agree well with Mme. Weber-van Bosse's description, but she expresses some reservation regarding identity with Zanardini's plant. There is no other credible record beyond that from the Virgin Islands, in our area.

VENEZUELA: Dredged from 38-40 meters off a bottom of dead coral fragments and coralline algae at sta. A44 near Tortuga Island, no. 39-560 (in part), 21 April 1939.

#### *Peyssonnelia rubra* (Greville) J. Agardh

Weber-van Bosse in Børgesen 1915-20, p. 146; Taylor 1928, p. 202.

Attached to coralline algae in moderately deep water; frequently reported from our area, and known from Bermuda and Florida to Panama.

COLOMBIA: Dredged from 24 meters off a bottom of calcareous algae and gray sand at sta. A13 near Cape LaVela, no. 39-272, 8 April 1939; dredged from 14-16 meters off a bottom of coralline algae at sta. A15 near Bahia Honda, nos. 39-295, 39-296, 39-297 (mostly in minor part), 8 April 1939.

## Corallinaceae

Plants with a thin basal layer from which may be developed either a thick crust, a system of rigid branches, or an articulated branch system; structurally multiaxial; calcified except where flexibly jointed; reproductive organs in conceptacles sunken in the crust or terminal on enlarged branchlets; tetrasporangia zonate; spermatangia on short filaments crowded in conceptacles; carpogenic branches three-celled, in the central part of the conceptacle, the lower cell acting as an auxiliary cell; after fertilization sending ooblast filaments to basal cells of other branches, following which general fusions occur and from the large fusion cell carpospores are produced marginally.

It is impossible at this time to give a comprehensive account of the crustose species collected on the 1939 expedition. Only a few of the most obvious and easily identified are, therefore, included.

### KEY TO GENERA

1. Plants flexibly articulated; branching dichotomous . . . 5
1. Plants crustose or, if lobed or forming free branches, these completely calcified . . . . . 2
2. Crusts thin; plants chiefly epiphytes . . . . . 3
2. Crusts more or less massive and often bearing free branches; seldom growing on living plants . . . . . 4
3. Tetrasporangial conceptacles discharging by a single pore . Foslarella
3. Tetrasporangial conceptacles discharging by many pores . Melobesia
4. Tetrasporangial conceptacles single pored . . . . . Goniolithon
4. Tetrasporangial conceptacles soriform, discharging by several pores . . . . . Lithothamnion
5. Conceptacles terminal in swollen segments . . . . . Jania
5. Conceptacles sessile and lateral on the segments . . . . . Amphiroa

### FOSLIELLA Howe, 1920

Plants forming thin, lightly calcified crusts adherent to the substratum, of one to few cell layers, the basal of radial cell rows; conceptacles superficial or slightly immersed, rounded conical, with a single pore; sporangia associated with evanescent trabeculae; cystocarpic conceptacles similar, smaller.

### KEY TO SPECIES

1. Colorless swollen cells at intervals in the vegetative thallus; disks 2-5 mm. diam. . . . . *F. farinosa*

- Disks not continuous, filaments in part free, in part forming small fanlike plates . . . . . var. *Solmsiana*
1. Colorless swollen cells absent, disks about 2 mm. or less in diameter . . . . . F. *Lejolisii*

***Fosliella farinosa* (Lamouroux) Howe**

Howe 1920, p. 587; Taylor 1928, p. 211 (as *Melobesia farinosa*); 1937, p. 270; 1939, p. 10.

An epiphytic plant, common on leaves of *Thalassia* and other tropical marine phanerogams, as well as algae, in shallow protected waters. It has been reported from temperate waters, as well as Bermuda and North Carolina to Brazil.

PANAMA: Caledonia Harbor, near the shore in the neighborhood of Isla Piedra and I. San Augustin, on *Thalassia*, no. 39-175a, 3 April 1939, and on *Padina*, no. 39-229, 4 April 1939. VENEZUELA: Dredged as an epiphyte on *Thalassia* from 3.5-9.0 meters' depth, the bottom being of coral sand and algae, at sta. A22 near Tortuga Island, no. 39-426a, 13 April 1939.

var. *Solmsiana* (Falkenberg) Taylor

Taylor 1939, p. 11, pl. 1, fig. 1c.

Found in localities like those favored by the species; the most distinctive examples found on such plants as *Valonia*.

BRITISH WEST INDIES: Tobago Island, on *Valonia ventricosa* from Buccoo Reef, no. 39-515b, 20 April 1939.

***Fosliella Lejolisii* (Rosanoff) Howe**

Howe 1920, p. 588; Taylor 1928, p. 211 (as *Melobesia Lejolisii*); 1937, p. 270, pl. 36, figs. 6-8.

A common plant in temperate as well as a frequent one in tropical American waters, forming more or less overlapping thin pinkish crusts on such plants as *Zostera* in the north and *Thalassia* in the tropics, as well as other phanerogams and algae. It is commonest in shallow water, and has been reported from northeastern North America to Brazil.

VENEZUELA: Tortuga Island, on *Thalassia* about Punta Arenas, no. 39-421a, 13 April 1939. BRITISH WEST INDIES: Tobago Island on *Thalassia*, drifted ashore in Rockly Bay, no. 39-501b, 18-20 April 1939; on *Thalassia* in Buccoo Bay, no. 39-557b, 20 April 1939.



**MELOBESIA** Lamouroux, 1812**Melobesia membranacea** (Esper) Lamouroux

Plants forming a thin membrane, at first reddish, later thicker, calcified, and more whitish; monostromatic except about the receptacles; tetrasporangial conceptacles 110-200  $\mu$  diam., scattered, wartlike, with 8-27 pores; sexual conceptacles somewhat hemispherical, the apertures contracted by filiform cells projecting from the walls.

Taylor 1937, p. 267; 1940, p. 556, pl. 20, fig. 1.

A rather frequent plant in tropical waters, forming crusts with *Fosliella* on *Thalassia* and other plants. It is recorded from Florida to Colombia.

PANAMA: Caledonia Harbor, on *Thalassia* in shallow water near Isla Piedra and I. San Augustin, no. 39-175b, 3 April 1939; dredged on *Thalassia* from a bottom of mud and fine sand at 2-13 meters' depth at sta. A2 near Caledonia Harbor, no. 39-211, 3 April 1939. VENEZUELA: Tortuga Island, growing on leaves of *Thalassia*, Punta Arenas, no. 39-421b, 13 April 1939; dredged on leaves of *Thalassia* from 3.5-9.0 meters' depth off a bottom of coral sand and algae, no. 39-426b, 13 April 1939. BRITISH WEST INDIES: Tobago Island, growing on leaves of *Thalassia* washed ashore in Rockly Bay, no. 39-501b, 18-20 April 1939; on leaves of *Thalassia* in Buccoo Bay, no. 39-557a, 20 April 1939.

**GONIOLITHON** Foslie, 1900**Goniolithon decutescens** (Heydrich) Foslie

Plant crustose, calcified, spreading over the substratum, the basal crust bearing erect, subsimple terete and rather tapering branches 1-4 mm. long; of a hypothallium of several layers and upper tissue or perithallium of many layers.

Howe 1920, p. 585; Taylor 1928, p. 208, pl. 36, fig. 3; Foslie 1929, p. 31, pl. 49, figs. 8-11 (as *G. spectabile* f. *nana*).

Reported from Bermuda and Florida to the Virgin Islands.

PANAMA: Dredged from 2-13 meters off Caledonia Harbor, sta. A2, no. 39-215, 3 April 1939. BRITISH WEST INDIES: Tobago Island, occasional on broken corals on Buccoo Reef, no. 39-555, 20 April 1939.

**LITHOTHAMNION** Philippi, 1837

Plants crustose, or erect and often branching from a crustose base; structurally of two layers, the basal or hypothallium spreading, the upper

or perithallium transversely zonate; sporangial conceptacles soriform, superficial or somewhat immersed, at first separate but later those adjacent fusing, discharging through several pores; cystocarpic conceptacles superficial or slightly immersed, conical or subconical, at first with a projecting tip, discharging by an apical pore.

#### KEY TO SPECIES

1. Small plant, branched, to about 1.5-3.0 cm. broad, the branches 0.75-1.50 mm. diam. . . . . *L. occidentale*
1. Larger plant, branched, to 6 cm. broad, the branches 1.5-3.0 mm. diam. . . . . *L. calcareum*

#### *Lithothamnion occidentale* Foslie

Lemoine in Børghesen 1915-20, p. 157, fig. 152; Taylor 1928, p. 210, pl. 37, fig. 11.

A tropical species known from Florida, Hispaniola, and the Virgin Islands. It has been secured by dredging from moderately deep water.

NETHERLANDS WEST INDIES: Numerous small specimens mixed with coarse sand dredged from 48 meters at sta. A18, off Aruba Island, no. 39-360, 10 April 1939.

#### *Lithothamnion calcareum* (Pallas) Areschoug?

Foslie 1929, p. 39.

Reported from Brazil, but this report not confirmed. The present material agrees in shape with illustrations given by Foslie in his monograph under more than one form name.

COLOMBIA: Dredged in abundance from 14-16 meters at sta. A15 off Bahia Honda, 8 April 1939.

#### JANIA Lamouroux, 1812

Plant arising from an inconspicuous disk, freely dichotomously branched, the branches segmented, the segments cylindrical, calcified, separated by uncalcified articulations; conceptacles usually single in swollen terminal segments of the main branches, which often continue further growth by the formation of a pair of branches lateral to the conceptacle.

#### KEY TO SPECIES

1. Branches spreading with wide angles, the segments generally 50-100  $\mu$  diam., 4-10 times as long as broad . . . *J. capillacea*

1. Branching erect, with narrow angles, the segments generally 100-160  $\mu$  diam., 4-6 times as long as broad, the tips acute . *J. rubens*

***Jania capillacea* Harvey**

Harvey 1853, p. 84; Børgesen 1915-20, p. 198, fig. 188; Taylor 1928, p. 206, pl. 29, figs. 2, 10.

A rather common tropical species known from Florida and the Bahamas to Brazil. It usually grows upon other algae in mixed associations, and is found from the littoral to water of very moderate depths.

PANAMA: Caledonia Harbor, occasional as an epiphyte on *Digenia* on rocks in shallow water near Isla Piedra and I. San Augustin, no. 39-205, 3 April 1939, and no. 39-237, 4 April 1939.

***Jania rubens* (Linnaeus) Lamouroux**

Taylor 1928, p. 206, pl. 29, figs. 3, 6.

A common alga which is found only in tropical waters in the western Atlantic; it is reported from Bermuda and Florida to Brazil.

COLOMBIA: An anomalous specimen dredged from 16-18 meters' depth at sta. A15 near Cape LaVela, no. 39-286, 8 April 1939.

**AMPHIROA Lamouroux, 1812**

Basal part usually a small disk, which bears erect calcified segmented branches di- or trichotomously divided, usually cylindrical, sometimes flattened or showing a thicker midrib and thinner margin; conceptacles lateral, sunken in the branches, often somewhat projecting.

**KEY TO SPECIES**

1. Branches frequently flattened, without midrib . . . *A. Hancockii*
1. Branches not at all flattened . . . . . 2
2. Branches 0.15-0.60 mm. diam., the nodes at the dichotomies, the segments commonly abruptly swollen at the ends . . . . . *A. fragilissima*
2. Branches 0.45-1.40 mm. diam., the nodes mostly above the dichotomies, the ends of the segments not swollen . . . . . *A. rigida* var. *antillana*

***Amphiroa fragilissima* (Linnaeus) Lamouroux**

Børgesen 1915-20, p. 185; Taylor 1928, p. 204, pl. 29, fig. 11, pl. 36, fig. 6.

A common plant in shallow water throughout the American tropical Atlantic, growing on stones, corals, and shells in moderately deep to most commonly very shallow water, often forming considerable turfs 2-4 cm. thick. It has been reported from Bermuda and North Carolina to Brazil.

PANAMA: Caledonia Harbor, abundant among collections from rocky ledges in shallow water near Isla Piedra and I. San Augustin, *no. 39-219*, 4 April 1939. BRITISH WEST INDIES: Tobago Island, good clumps rather infrequent, scattered over Buccoo Reef, *no. 39-549*, 20 April 1939.

*Amphiroa rigida* Lamouroux, var. *antillana* Børgesen

Børgesen 1915-20, p. 182, figs. 171-173; Taylor 1928, p. 204, pl. 29, fig. 1.

Infrequent in shallow water, or water a few meters deep. This plant has seldom been reported, but is known (either the species or the variety) from Florida to the Virgin Islands and Panama.

PANAMA: Caledonia Harbor, occasional in shallow water near Isla Piedra and I. San Augustin, *no. 39-206*, 3 April 1939.

*Amphiroa Hancockii* n. sp.<sup>6</sup>

Plate 13, Figs. 1, 2

Plants arising from an inconspicuous basal stratum, to at least 5 cm. tall, irregularly and divaricately stoutly branched, with frequent adventitious branches lateral to the 2-4-chotomous system; branching complicate to less usually radial; segments smooth, sometimes almost terete to slightly compressed, particularly in the lower segments and the adventitious branchlets, more generally uni- or bifacially flat, or even canaliculate; segments straight or sometimes arcuate, cylindrical to flat and triangular, or at the upper end bifid so that the arms may be even 2-4 times as long as the undivided part of the segment, or sometimes 3-4-fid, or bearing branches laterally, and occasionally a second stage of division accomplished without the intervention of an uncalcified articulation; terminal branchlets tapering; diameter of segments to 5-8 mm., or more

<sup>6</sup> *Amphiroa Hancockii*—Planta strato basali inconspicuo, parte erecta complicate, ramos crassos, irregulatis, divaricatosque necnon ramulos frequentis, lateralis, adventitiosque habente; segmentis levibus, plerumque planis facie in una aut utraque, ad usque 5-8 mm. latitudine, extrema parte distali simplici aut 2-3-4-fid, interdum bis ramoso; ramulis terminalibus attenuatis; conceptaculis frequentibus in segmentis fertilibus poro inconspicuo praeditis. Planta typica in loco dicto Caledonia Harbor, Panama, *no. 39-244*, 4 April 1939.

just below a fork, commonly 3-5 mm., length to 30 mm. and, where articulations are omitted between forkings, to 50-60 mm.; conceptacles crowded, nearly covering fertile segments, little elevated, with a single inconspicuous pore, 210-270  $\mu$  diam.

PANAMA: Caledonia Harbor, occasional good tufts among corals in deep tide pools near Isla Piedra and I. San Augustin, no. 39-244, 4 April 1939. Probably the plants provisionally listed as *A. Tribulus* from Columbus Island (Taylor 1929b, p. 629) belong to this species.

This plant, among other Amphiroas of the West Indian area, most resembles *A. Tribulus*. It differs in the much stouter branches which are frequently not jointed at the forkings and in the segments being much thicker, without any suggestion of a midrib.

## Grateloupiaceae

Plants with a flat blade, or bushy with terete branches variously divided; structurally filamentous; sporangia tetrapartite, scattered or in nemathecia; carpogenic branch two-celled, lateral on a cortical filament; auxiliary cell intercalary near the base of a cortical filament cluster not associated with a carpogenic branch; ooblast filaments passing direct from the carpogonia to auxiliaries; cystocarp discharging by a well-defined pore.

### KEY TO GENERA

1. Texture firmly membranous; tetrasporangia in nemathecia  
   . . . . . Cryptonemia
1. Texture softer, blades relatively thick; tetrasporangia scattered  
   . . . . . 2
2. Branching pinnate to somewhat irregular; texture firm, cortex clearly filamentous  
   . . . . . Grateloupia
2. Foliaceous or branched, the branching dichotomous to irregular; texture soft, nearly gelatinous, the cortex pseudoparenchymatous  
   . . . . . Halymenia

### CRYPTONEMIA J. Agardh, 1842

#### *Cryptonemia crenulata* J. Agardh

Plants of moderate size, to about 10 cm. tall, with an inconspicuous attachment disk and short, subcylindrical stem; above branching dichotomously, and flattened, but without any midrib, the branches to 3-5 mm. broad, and the segments 5-15 mm. between forkings, which are moder-



ately narrow and the branches erect; texture rather crisply membranous; margin near the tips minutely crenulate; color dull purplish red.

Taylor 1928, p. 198, pl. 27, fig. 22, pl. 28, figs. 9, 12, 13.

A rather frequently observed plant in the West Indies, growing in moderately deep water; it has been reported from Bermuda and North Carolina to Brazil.

BRITISH WEST INDIES: Tobago Island, numerous tufts washed ashore in Buccoo Bay, no. 39-543, 20 April 1939.

### GRATELOUPIA C. Agardh, 1822

Plants of moderate to considerable size, foliaceous to bushy, the branching generally pinnate and complanate; the branches flat; texture fleshy to membranous, moderately firm; structurally showing a medulla of slender filaments which anastomose, surrounded by jelly, and a cortex of radiating moniliform filaments covered by a more or less firm jelly; sporangia tetrapartite, immersed in the cortex; cystocarps minute, scattered or in sori, immersed in the cortex and surrounded by a thin pericarpic layer.

#### KEY TO SPECIES

1. Plant with a few foliaceous segments, to 4-5 cm. broad . . . . . *G. cuneifolia*
1. Plant with a compressed percurrent axis to 0.5-2.0 cm. broad, freely pinnately 1-3 times branched, the narrow branches forming a flat blade . . . . . *G. filicina*

#### *Grateloupia cuneifolia* J. Agardh

Kützing 1867, p. 10, pl. 34; Børgesen 1915-20, p. 12, figs. 134-136.

Infrequently reported, but known from a few stations in the Caribbean region between the Virgin Islands and Brazil. It seems to be a plant of shallow water.

BRITISH WEST INDIES: Tobago Island, a fragment washed ashore in Buccoo Bay, no. 39-527, 20 April 1939.

#### *Grateloupia filicina* (Wulfen) C. Agardh

Kützing 1867, p. 7, pl. 22; Børgesen 1915-20, p. 123.

Frequent in shallow water throughout the Caribbean region, though not found in extremely exposed situations; it has been reported from North Carolina to Brazil. It is extremely variable.

VENEZUELA: Tortuga Island, washed ashore in some quantity on Punta Arenas, no. 39-379, 13 April 1939. This specimen was in form

rather intermediate between Kützing's figure of *G. caudata* in having long narrow branches (1867, p. 7, pl. 23 d) and his figure of *G. concatenata*, where the linear branchlets are chiefly near the bases of the branches, in even close-placed series (1867, p. 7, pl. 24 c, d). Cubagua Island, frequent on rocky ledges near the beach in shallow water, no. 39-455, 14 April 1939.

### HALYMENIA C. Agardh, 1817

Plants of moderate to considerable size, foliaceous or bushy, generally of quite softly fleshy consistency; when branched variously lobed or dichotomously or pinnately divided; structurally showing in the medulla slender filaments well separated in a soft jelly, often radiating from conspicuous ganglia, the cortex of large cells within, small cells without, not in evident filamentous arrangement; tetrasporangia tetrapartite, scattered and immersed in the cortex; cystocarps immersed, with a pericarp of slender filaments, discharging through a definite pore.

#### KEY TO SPECIES

1. Plant cylindrical throughout, bushy, to 1-2 dm. tall, the branches about 5-8 mm. diam., the forkings about 2-3 cm. apart . . . . . H. Agardhii
1. Plant foliaceous, or if the segments very narrow, strongly compressed . . . . . 2
2. Plant rarely lobed, margin entire; blade thin . . . H. Hancockii
2. Plant lobed, serrate or dissected; blade thicker . . . 3
3. Plant foliaceous, ovate, to 2.5 dm. tall, becoming lobed, the marginal lobes broadly triangular, the margins irregularly serrate . . . . . H. floridana
3. Plant subfoliaceous, to 3 dm. tall, with flat main axis and chief branches to 1-2 cm. broad, the branching repeatedly pinnate and complanate, the branchlets to 1-3 mm. broad . . . . . H. Floresia

#### *Halymenia Hancockii* n. sp.<sup>7</sup>

Plate 3, Fig. 6; Plate 14, Figs. 1-5

Thallus with a short (1-3 mm.), slender cylindrical stipe; blade lanceolate or more generally oblanceolate, the base narrowly tapering,

<sup>7</sup> *Halymenia Hancockii*—Planta stipitem brevem gracilemque necnon laminam lanceolatam aut oblanceolatam, basi anguste attenuata, apice obtuse rotundato,

the apex obtusely rounded, the margin entire; generally simple, rarely bifurcate, occasionally with marginal or submarginal proliferations similar to the primary blade, especially after an injury; to about 10 cm. tall, 2 cm. broad, pinkish to dull reddish-purple; thickness 35-40  $\mu$  (soaked up), with a cortex one cell layer in thickness, the cells about 8-10  $\mu$  diam. in surface view and 8  $\mu$  thick, the medulla loosely filamentous, conspicuous stellate cells absent, 3-4-branched subcortical cells present, inconspicuous; very slightly nitent when dry; sporangia numerous, scattered between the cortical cells, tetrapartite, 12-17  $\mu$  diam. in surface view; pericarps 200-280  $\mu$  diam., without an evident pore, the outer wall generally one cell thick, showing a considerable space between it and the cystocarp loosely filled with slender filaments.

COLOMBIA: South of LaVela, dredged from 24 meters' depth off a bottom of gray sand at sta. A13, no. 39-270b, 7 April 1939; Galera Point, dredged from a sandy bottom at 22 meters' depth at sta. A48, no. 39-617, 25 April 1939.

At first it was expected that these small *Halymenias* were simply deep-water, underdeveloped variants of larger species. However, with the structural data in hand it seems improbable that this is the case, and the vegetative and fruiting characters together seem quite enough to characterize them as a new, deep-water species. It is probable that larger size and more complete forking will later be demonstrated in more ample collections.

### *Halymenia floridana* J. Agardh

Collins and Howe 1916, p. 172; Taylor 1928, p. 200.

A plant very seldom reported, and, so far as the writer is aware, not adequately figured. It has previously been reported from North Carolina and Florida.

COLOMBIA: One fragment dredged from 24 meters' depth off a bottom of gray sand at sta. A13 near Cape LaVela, no. 39-270a, 8 April 1939. NETHERLANDS WEST INDIES: Young plants frequent in material dredged from 43 meters' depth off a bottom of sand and coralline algae at sta. A18 near Aruba Island, no. 39-345a, 10 April 1939.

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margine integro, habens; plerumque simplex, interdum furcata aut prolifera; altitudine usque ad 10 cm., latitudine usque ad 2 cm., crassitudine usque ad 35-40  $\mu$  madefacta, corticem unicellularem et medullam filamentosam sine conspicuis cellulis stellatis habens; tetrasporangiis numerosis atque non aggregatis, 12-17  $\mu$  diam.; pericarpis numerosis atque non aggregatis, 200-280  $\mu$  diam. Planta typica in loco dicto Galera Point, Colombia, no. 39-617, 25 April 1939.

**Halymenia Floresia** (Clemente) C. Agardh

Kützinger 1866, pp. 31, 32, pls. 88, 89; Taylor 1928, p. 199, pl. 28, fig. 18, pl. 35, fig. 6.

Probably a common plant throughout the region, having been reported by numerous collectors and ranging from North Carolina to Brazil. It is a plant which grows on coral fragments, shells, and the like in moderately deep water.

VENEZUELA: Tortuga Island, frequent as washed ashore on Punta Arenas, no. 39-414, 13 April 1939. BRITISH WEST INDIES: Tobago Island, rare, a fragment washed ashore in Buccoo Bay, no. 39-531, 20 April 1939.

**Halymenia Agardhii** De Toni

Taylor 1928, p. 109, pl. 26, fig. 18, pl. 28, fig. 8.

A plant infrequently reported and inadequately figured. It has been secured from a few stations between Bermuda, North Carolina, and Guadeloupe, and grows in moderately deep water.

BRITISH WEST INDIES: Tobago Island, rare fragments washed ashore, Buccoo Bay, no. 39-530, 20 April 1939.

**Nemastomataceae**

Plants foliaceous or somewhat branched, of moderate size, and of very soft texture; structurally showing a filamentous medulla with radial filaments forming the assimilatory cortex, all immersed in a copious jelly; sporangia tetrapartite; spermatangia formed on the outer cells of the cortex; carpogenic branches of three to seven cells, developed on the cortical filaments; auxiliary cells scattered, intercalary in the cortical filaments; carpogonia developing ooblast filaments after fertilization, by which they connect with the auxiliary cells, the cystocarps developed outwardly from these, not enveloped by pericarp filaments.

**PLATOMA** (Schousboe) Schmitz, 1889

Plant simple or branched, plane to subcylindrical, the branching dichotomous or alternate to irregular; medulla thick, cortex wide, of radial filaments often bearing gland cells, and all invested by a soft jelly; sporangia tetrapartite, scattered; carpogenic branches three-celled.

## KEY TO SPECIES

1. Plant closely but irregularly pinnately branched, the branches redividing 2-3 times, 1-3 mm. wide . . . . . *P. cyclocolpa*
1. Plant forming a simple, or slightly lobed thick blade . . . . . *P. tenuis*

***Platoma cyclocolpa* (Montagne) Schmitz**

Plate 12, Fig. 2

J. Agardh 1879, pp. 63, 164, pl. 4, figs. 1-4 (as *Nemastoma multifida*); Børgesen 1925-30, p. 9.

Reported only from Bermuda and Guadeloupe in our territory, this plant probably grows in water of moderate depth. The specimens secured showed more regular branching than figured by Agardh.

NETHERLANDS WEST INDIES: Infrequent as dredged from 43 meters' depth off a bottom of sand and coralline algae at sta. A18, near Aruba Island, no. 39-347, 10 April 1939.

***Platoma tenuis* Howe and Taylor**

Howe and Taylor 1931, p. 32, text-fig. 15b, pl. 2, fig. 1.

Previously known only from the type collection, which was secured by dredging off the Brazilian coast.

NETHERLANDS WEST INDIES: Rare fragments dredged at 43 meters' depth off a bottom of sand and coralline algae at sta. A18 near Aruba Island, no. 39-352, 10 April 1939.

**Solieriaceae**

Plant bushy, the branches rounded or somewhat compressed, firmly fleshy; structurally showing a loosely filamentous medulla and a falsely parenchymatous cortex; tetrasporangia formed at the surface, zonate; carpogenic branches of three or four cells borne on the inner cortex; scattered auxiliaries similarly placed; cystocarps immersed, showing a central fusion mass or sterile tissue, and discharging by a pore.

**AGARDHIELLA Schmitz, 1889**

## KEY TO SPECIES

1. Plant irregularly 1-3 times alternately radially or somewhat unilaterally branched, the branches firm, cylindrical, 1-3, rarely to 20 mm. diam., tapering sharply to the tips and contracted at the bases . . . . . *A. tenera*



1. Plant regularly 1-2 times, sometimes partly a third time, oppositely or somewhat irregularly branched, complanate, the branches somewhat softer, the lesser compressed, the main axis quite flat and to 1 cm. or more broad . . . *A. ramosissima*

***Agardhiella tenera* (J. Agardh) Schmitz**

Harvey 1853, p. 121, pl. 23A (as *Solieria chordalis* p.p.); Taylor 1928, p. 147; 1937, p. 286, pl. 38, fig. 4, pl. 40, fig. 7, pl. 41, fig. 2, pl. 59, fig. 9.

Common in temperate regions, growing in quiet harbors in shallow water; in our tropical area it is known from the Bahamas and Florida to Brazil. In the tropics it does not seem to reach as large stature as it does in southern New England, and is most often secured by dredging.

VENEZUELA: Dredged from 25.5 meters' depth off a bottom of sand and algae at sta. A24 near Cubagua Island, no. 39-480, 14 April 1939. BRITISH WEST INDIES: Tobago Island, abundant as washed ashore in Rockly Bay, no. 39-500, 18-20 April 1939. These Tobago specimens are notable for the highly ramified basal portion, which is much more developed than usual, probably representing an adaptation to growth in very coarse shell sand.

***Agardhiella ramosissima* (Harvey) Kylin**

Harvey 1832, p. 190, pl. 30B (as *Chrysomenia ramosissima*); Kylin 1932, p. 17.

Previously known only from North Carolina, Florida, and to Guadeloupe, from a very few stations.

VENEZUELA: Tortuga Island, frequent as drifted ashore on Punta Arenas, no. 39-371, 13 April 1939.

## Rhabdoniaceae

Thallus cylindrical or flattened, radially or bilaterally branched, medulla filamentous, cortex of close, radial rows of cells, the inner large, the outer small and rich in chromatophores. Tetrasporangia zonate, scattered over the thallus in the outer cortex. Cystocarps immersed in the thallus, the carpogenic branch two to five celled, the auxiliary cell developed after fertilization. The cystocarp, in which the carpospores radiate from a large fusion cell, discharges through a pore, although a special pericarp tissue is not developed.

**CATENELLA** Greville, 1830**Catenella repens** (Lightfoot) Batters

Plant creeping or pulvinate, to 3 cm. tall, dull purple; branched, di- or trichotomous or in part pinnate, the branches like the axis, segmented, the segments compressed, narrowly ellipsoid to ovate; tetrasporangia in long, acute segments; cystocarps in short, ovate to subspherical segments.

Børgesen 1915-20, p. 359, fig. 354; Taylor 1928, p. 148, pl. 22, fig. 18 (both as *C. Opuntia*).

This plant is generally found on decaying wood, or on mangrove stems and roots in the intertidal zone. It has not been reported very frequently, but this may be due to the fact that the situation in which it is to be found does not ordinarily attract phycologists, and the plants are commonly all but covered with mud. It has been reported from Bermuda and Florida to Martinique.

PANAMA: Caledonia Harbor, on mangrove roots in a lagoon behind the marginal forest near the southeastern harbor entrance, *no. 39-618a*, 27 April 1939.

**Hypneaceae**

Plants bushy, cushionlike to large and virgate-spreading; growing from an apical cell and usually showing a persistent axial cell row, the cortex falsely parenchymatous; zonate sporangia immersed at the surface, grouped in the swollen parts of small lateral branchlets; carpogenic branches usually three-celled, the supporting cell outwardly developing additional branched cell series, of which a lower intercalary cell near the carpogonium is the auxiliary, with which the carpogonium fuses after fertilization, and from which the gonimoblasts are formed in association with nutritive tissue within the poreless pericarp.

**HYPNEA** Kützinger, 1813**KEY TO SPECIES**

1. Plants large and erect . . . . . 2
1. Plants matted, small . . . . . *H. spinella*
2. Plants widely branched, often entangled, dichotomous to irregular with numerous lateral spinelike branchlets, the main axes indistinct above . . . . . *H. cervicornis*

2. Plants with more erect branching, little entangled, the main axes remaining distinct, spinelike lateral branchlets nearly absent, or common, or even closely crowded; principal branches commonly ending in swollen crozierlike tips . . . *H. musciformis*

All except the most striking phases of species in this genus are difficult of identification, and juvenile specimens or depauperate examples from surf-beaten rocks constantly trouble the worker with tropical marine algae. For the most part these remain indeterminable.

### ***Hypnea cervicornis* J. Agardh**

Taylor 1928, p. 156, pl. 22, fig. 11.

Common throughout tropical American waters, but ill-defined and dwarfed specimens are always confusing. It occurs in shallow water or down to a very few meters when dredged, on coral and shell fragments or on rocks. It has been frequently reported, and is known from Bermuda and Florida to Brazil.

PANAMA: Caledonia Harbor, infrequent among shore collections taken from shallow water near Isla Piedra and I. San Augustin, *no.* 39-195, 3 April 1939. It is notable that the axes of these specimens tend to be compressed, and that the wide general branching is replaced by more persisting chief axes and more crowded, forked lateral branchlets. NETHERLANDS WEST INDIES: Curaçao Island, abundant in a concrete-sided, mud-bottomed bathing pool, Jan Thiel Beach, *no.* 39-583, 23 April 1939. VENEZUELA: Tortuga Island, rare as washed ashore on Punta Arenas, *no.* 39-385, 13 April 1939.

### ***Hypnea musciformis* (Wulfen) Lamouroux**

Taylor 1928, p. 156, pl. 22, fig. 10, pl. 23, fig. 12; 1937, p. 291, pl. 37, fig. 2.

Common from Massachusetts south into tropical American waters, growing in rather shallow, but quiet water, and reaching Brazil. It is noticeable that the habit of the plant in the tropics is different from that in the northern extremity of its range, for the branches are more widespreading, the hooked tips much more abundant, and the color of the plant more reddish or yellowish.

PANAMA: Caledonia Harbor, common in shallow water near Isla Piedra and I. San Augustin, *no.* 39-196, 3 April 1939. COLOMBIA: Cienaga, driftweed taken over the side of the ship, *no.* 39-250, 6 April 1939. VENEZUELA: Cubagua Island, common on rocks in very shallow

water along the beach, no. 39-450, 14 April 1939. Specimens from this collection agreed very well with Kützinger's figure of *H. hamulosa* (Turner) Montagne, but were nearly black in color and showed other minor differences. Cubagua Island, frequent from ledges and scattered rocks, no. 39-469, 14 April 1939. This was the ordinary tropical form of the species. Tortuga Island, frequent as drifted ashore on Punta Arenas, nos. 39-404, 39-417, 13 April 1939. NETHERLANDS WEST INDIES: Aruba Island, frequent on rocks in shallow water of the cove at Punta Basora, no. 39-334, 10 April 1939; Curaçao Island, frequent on rocks along the shore in shallow water, Jan Thiel Beach, no. 39-605, 23 April 1939. BRITISH WEST INDIES: Tobago Island, occasional in Buccoo Bay, no. 39-513, 20 April 1939; occasional with *Halophila*, dredged at 16-23 meters' depth off a muddy bottom at sta. A38 near Tobago Island, no. 39-504, 19 April 1939.

***Hypnea spinella* (C. Agardh) Kützinger**

Børgesen 1915-20, p. 384, fig. 369.

Occasionally reported from the West Indian region, growing on rocks in shallow water, known from Bermuda to Brazil.

VENEZUELA: Cubagua Island, frequent and forming dense cushions on rocks in shallow water, no. 39-466, 14 April 1939. BRITISH WEST INDIES: Tobago Island, matted into a close turf on the coral rocks, Buccoo Reef, no. 39-544, 20 April 1939.

**Plocamiaceae**

Plant bushy, the branches compressed to flat and membranous, branching from the margin in sympodial fashion to form a flat blade, the lateral branches bearing branchlets in small groups; apical cell and axial cell row evident, the cortex apparently parenchymatous; tetrasporangia borne on special small branchlets, zonate; carpogenic branch of three cells, borne on a supporting auxiliary cell; cystocarps scattered along the margins of the thallus or in special branchlets, without evident pores.

**PLOCAMIUM Lamouroux, 1813**

***Plocamium brasiliensis* (Greville) Howe and Taylor**

Plant light reddish purple, 5-9 (or more?) cm. tall, 2-3 times pinnate, ecostate or slightly costate at the extreme base, the pinnae in alter-

nate pairs, the lower of each pair simple, falcate, lanceolate or long deltoid, acuminate, entire or somewhat denticulate on the outer margin, 2-4 mm. long, 0.5-1.5 mm. wide at the base, the upper of each pair pinnate or pinnatifid in much the same fashion as the larger branches or, occasionally, remaining subsimple.

Howe and Taylor 1931, p. 14, figs. 7, 8.

Previously only known from Brazil, where it probably grew in deep water.

NETHERLANDS WEST INDIES: Aruba Island, rare fragments dredged from 43 meters off a bottom of sand and coralline algae, *no.* 39-348, 10 April 1939. These fragments were small and slender, compared with the bulk of the Brazilian material from the Hassler Expedition studied by the writer. It might be questioned whether these were not rather *P. coccineum*, which has been reported, though not particularly reliably, from both Jamaica and Brazil. In that species the short branches are not clearly in pairs, but rather in short series of 3-5 in succession on one side of the axis and then on the other; and, when these branch, the branchlets tend to be, not alternate, but on the upper side of the minor axis bearing them. The determination of a specimen from Piedra de Itapuca, Rio de Janeiro as *P. coccineum* (Taylor 1930, p. 632) is probably incorrect, and the plant a small and delicate *P. brasiliensis*.

## Gracilariaceae

Plants bushy, branched, the branches cylindrical or flattened, dichotomously or pinnately to subpalmately divided, firmly cartilaginous; structure parenchymatous; sporangia scattered at the surface, tetrapartite; spermatangia formed in crypts; carpogenic branches of two cells, the carpogonium fusing with the cell below and others to give rise to a large cell from which the gonimoblasts are produced; cystocarp with a large central placenta, discharging through a pore in the thick, projecting pericarp.

### GRACILARIA Greville, 1830

#### KEY TO SPECIES

1. Thallus terete or nearly so . . . . . 2
1. Thallus more or less flat, simple or more often di- or polychotomous or somewhat pinnate . . . . . 5



2. Ultimate branches filiform, commonly long, plants bushy and moderately soft . . . . . *G. confervoides*
2. Ultimate branches stout, or if slender, crowded, short and spinelike . . . . . 3
3. Branching coarse, loose and open . . . . . 4
3. Ultimate branching closely bushy, the branchlets short and spinelike, occasionally the main axes compressed . . . *G. ferox*
4. Closely, divaricately subdichotomous, the ultimate divisions often incurved, cervicorn . . . . . *G. damaecornis*
4. Branching open, somewhat fastigiately subdichotomous, commonly tending to be unilateral or with short unilateral branchlets, the plants coarse and cartilaginous . . . *G. cornea*
5. Prostrate, very thick and cartilaginous, with short, sometimes crowded branches, often concrescent, warty, recurved, but sometimes more narrow and subterete . . . . . *G. crassissima*
5. Plants erect . . . . . 6
6. Plants freely, generally pinnately branched, particularly on the flat main axes of older plants, above more irregularly branched and the branches more nearly cylindrical . . *G. cervicornis*
6. Plants essentially dichotomously branched, at least above 7
7. Plants more sparingly and nearly entirely dichotomously branched, the branches simply strap shaped and little tapered, grading from about 1 cm. wide below to at least 3 mm. in the upper divisions, rarely less . . . . . *G. mamillaris*
7. Plants bushy, involved, dichotomously or alternately branched below, dichotomously branched above, with numerous lateral subsimple marginal branchlets; narrow below, wider above and at the forkings, but very narrow (0.5-1.0 mm.) at the tapered branch tips . . . . . *G. venezuelensis*

It is not difficult to recognize this genus when the microscopic structure of sections of the thallus and the cystocarp are examined. However, it is quite another matter to make identifications to species. Dwarfed or young plants are generally indeterminate, and in many cases the only hope of dealing even with mature plants is by direct comparison with extensive series of well-determined specimens, because the variation is extreme.

#### ***Gracilaria confervoides* (Linnaeus) Greville**

Taylor 1937, p. 293, pl. 38, fig. 1.

A common plant in moderately quiet water, widespread through the

northern temperate and tropical regions; it has been reported from Bermuda and Florida to Brazil. The form generally secured on the present expedition was not always the short-branched, bushy form figured in the writer's book on northern algae, but sometimes approached that designated var. *longissima*, with attenuate, flagelliform ultimate branches.

PANAMA: Caledonia Harbor, rare on rocks in shallow water near Isla Piedra and I. San Augustin, no. 39-170, 3 April 1939. COLOMBIA: Juvenile and slender specimens dredged from 24 meters' depth off a bottom of gray sand at sta. A13 south of Cape LaVela, no. 39-265, 8 April 1939. VENEZUELA: Tortuga Island, rare as drifted ashore at Punta Arenas, no. 39-413, 13 April 1939; Cubagua Island, common on rocks along the beach, no. 39-471, 14 April 1939; rare as dredged at 25 meters' depth from a bottom of sand and algae at sta. A24 near Cubagua Island, no. 39-481, 14 April 1939. NETHERLANDS WEST INDIES: Curaçao Island, common near the intertidal zone on rocks near the pontoon bridge at Willemstad, no. 39-566a, 23 April 1939. BRITISH WEST INDIES: Tobago Island, rare in Buccoo Bay, no. 39-540, 20 April 1939.

#### **Gracilaria ferox** J. Agardh

Taylor 1928, pl. 33, fig. 2.

Frequent through the American tropics, principally considerably below low-tide line. Reported from Bermuda and Florida to Brazil.

PANAMA: Caledonia Harbor, common on rocks in shallow water near Isla Piedra and I. San Augustin, nos. 39-189, 39-228, 3, 4 April 1939.

#### **Gracilaria damaecornis** J. Agardh

Taylor 1928, p. 154.

Occasional through the American tropics, probably growing below low-tide line, on rocks. Reported from Bermuda and Florida to Tobago Island.

VENEZUELA: Tortuga Island, frequent as washed ashore on Punta Arenas, no. 39-378, 13 April 1939. BRITISH WEST INDIES: Tobago Island, occasional as washed ashore in Buccoo Bay, no. 39-543b, 20 April 1939.

#### **Gracilaria cornea** J. Agardh

Taylor 1928, p. 152, pl. 23, fig. 6, pl. 36, fig. 4.

Common throughout the American tropics, reported from Florida and Bermuda to Brazil. A plant which generally grows on rocks and broken corals in shallow water, or to a few meters' depth.

VENEZUELA: Tortuga Island, rare on Punta Arenas, no. 39-412, 13 April 1939; Cubagua Island, infrequent from ledges and rocks in shallow water along the beach, no. 39-470, 14 April 1939.

**Gracilaria crassissima** Crouan

Taylor 1928, p. 153, pl. 23, fig. 8, pl. 31, fig. 3.

A plant which is generally closely appressed against the rock on which it grows, and frequently on the under side or in a shaded cleft in shallow water. The species has not been frequently reported from the region of this study, but is known from Bermuda and Florida to Guadeloupe.

PANAMA: Caledonia Harbor, occasional from rocky ledges in shallow water near Isla Piedra and I. San Augustin, no. 39-227, 4 April 1939.

**Gracilaria cervicornis** (Turner) J. Agardh

A particularly variable species, reported very often from the West Indian region. The plants represented in the Tobago collection are notably pinnate, with the chief axes flattened. This form was issued in *Phycotheca Boreali-Americana* (no. 790) as *G. domingensis* Sond., and is quite different from P. B.-A. 787, which Collins considered to be *G. cervicornis*.

VENEZUELA: Cubagua Island, rare among collections from rocks along the beach, no. 39-467b, 14 April 1939. BRITISH WEST INDIES: Tobago Island, rare as washed ashore in Buccoo Bay, but plants large and notably pinnate, no. 39-524, 20 April 1939.

**Gracilaria** sp.

Plants to over 21 cm. tall, the axis and main branches sparingly irregularly alternately or polychotomously branched; branches erect, 1.5-2.5 mm. broad, compressed, becoming naked below, but above along the margins pinnately beset with many erect-spreading, often arcuate simple or sparingly divided minor branches 1.0-2.5 cm. long; smaller branches serrate-dentate to aculeate, or the aculei continued to small subcylindrical branchlets, which may bear a few teeth; branches near the tips sometimes subcorymbose.

VENEZUELA: Cubagua Island, frequent in shore collections from rocks along the shore, no. 39-458, 14 April 1939.

These plants were very distinctive indeed, and it was not anticipated that any difficulty would arise in determining their identity. However,

they were sterile, and the naked lower branches led to the suspicion that perhaps old and denuded specimens of some plant like *G. cervicornis* might here be regenerating. Consequently they are not either described as a new species or attached to a known one.

***Gracilaria venezuelensis* n. sp.<sup>8</sup>**

Plate 3, Fig. 10; Plate 15, Figs. 1, 2

Plant bushy, involved, to 10-13 cm. tall (perhaps more); color rose to dark reddish purple; thin and fragile in texture; axis sparingly alternately or dichotomously branched below, more closely and more definitely dichotomously complanately branched above, locally with numerous subsimple marginal branchlets; the axis somewhat compressed-oval in section in the lower parts, thin and flat above, 2-3 mm. wide below, becoming wider in the middle portion and often particularly so at the forks, but much tapered to the narrow (0.5-1.0 mm.) tips; cystocarps prominent, marginal or facial, 0.75-1.5 mm. diam.

VENEZUELA: Cubagua Island, dredged at 3.5-9.0 meters off a sandy bottom at sta. A24, no. 39-479a (cystocarpic), 14 April 1939, and at 3.5-9.0 meters off a bottom of coarse black sand, no. 39-482, 15 April 1939.

This extremely brittle *Gracilaria*, like many others in the genus, is hard to define. The densely involved habit, color, fragility, and pattern of branching seem distinctive (Plate 15). Structurally a thick medulla of large, thin-walled cells is surrounded by a thin cortex of small cells with chromatophores. The cystocarps show a thick projecting pericarp which externally is of cells in radiating rows, small and close without, larger and loose within. The mass of carpospores extends around three quarters or more of the periphery of the placenta, and is penetrated by a few scattered filaments connecting the placenta with the pericarp.

***Gracilaria mamillaris* (Montagne) Howe**

Taylor 1928, p. 154, pl. 23, fig. 7.

Infrequently reported from the American tropics, but widespread, being known from Bermuda and Florida to Brazil. This is a plant which

<sup>8</sup> *Gracilaria venezuelensis*—Planta ad usque 10-13 cm. altitudine, intricata, ramis infra sparse alternis aut dichotomis, supra arctius dichotomis complanatisque, sed subsimplicibus ramulis marginalibus inter furcas; axe infra compressa, ramis supra complanatis, tenuibus fragilibusque, 2-3 mm. latitudine infra, latioribus media in parte, ad cacumina angusta attenuatis. Planta typica in loco dicto Cubagua Island, Venezuela, no. 39-482, 15 April 1939.

grows on rocks and dead corals in the intertidal zone, or very little deeper.

PANAMA: Caledonia Harbor, frequent in shallow water, somewhat spreading-decumbent, near Isla Piedra and I. San Augustin, no. 39-225, 4 April 1939. VENEZUELA: Tortuga Island, fragments washed ashore on Punta Arenas, no. 39-372, 13 April 1939; Cubagua Island, common in clumps low down on rocks along the beach, no. 39-459, 14 April 1939. NETHERLANDS WEST INDIES: Curaçao Island, common on rocks near the pontoon bridge, Willemstad, no. 39-564, 23 April 1939.

### **Gracilaria sp.**

Plant exceeding 7 cm. in height, slender and thickened above the small holdfast, cuneate-expanded to the broad blade which in the lower portion may reach a width of 1-2 cm. above a fork, commonly 7-8 mm.; dichotomously to 4 (or more?) times divided at intervals of 1.5-2.0 cm., angles of 60°-100°, the tips broadly rounded or truncate, 4-7 mm. wide; color when dry dark purplish rose; texture thick, membranous, to 400  $\mu$  (or more?) in the lower branches; frequently marginally proliferous, the young proliferations cuneate-flabellate.

COLOMBIA: Bahia Honda, dredged at 14-16 meters' depth from a bottom of coralline algae at sta. A15, nos. 39-289, 39-292, 8 April 1939.

Of these fragmentary sterile specimens some were very broad, some narrower, but probably they represent different stages of the same thing. The possibility exists that they are wide, thin, deep-water forms of *G. mamillaris*.

### **Gracilaria sp.**

Plants to 7 cm. tall (or more?), the holdfast minute, the lower part of the thallus filiform, above simple, flat, linear lanceolate, or with a lateral lobe or terminal forking, or, perhaps only seldom, to 3 times forked; thallus 3-5 mm. wide, dichotomies 5-10 mm. apart, at angles of 60°-90°; color dark purple rose, texture firm, thick membranous; cystocarps often abundant even on simple specimens only 3 cm. tall.

COLOMBIA: South of Cape LaVela, dredged from 24 meters' depth on a bottom of gray sand at sta. A13, nos. 39-262, 39-271, 8 April 1939.

Coral fragments and broken shells frequently have small *Gracilarias* upon them. While one branched specimen in this series suggests *G. mamillaris*, the simple and subsimple ones do not show any resemblance, and so for the present this group is kept separate and specifically unidentified.



## Gigartinaceae

Plants usually bushy, sometimes undivided and plane, developing with a pseudoparenchymatous axis and an obscurely filamentous cortex; sporangia in sori, developed from branching rudiments, tetrapartite; spermatangia in superficial sori; carpogenic branches three-celled, borne upon supporting auxiliary cells from which branching gonimoblasts produce diffuse cystocarps in the medulla of the thallus.

### GIGARTINA Stackhouse, 1809

#### *Gigartina Teedii* (Roth) Lamouroux

Plants bushy, to 1 dm. tall, 1-3 times pinnately branched, complanate, the ultimate branchlets acute and somewhat spinelike; branches cylindrical or the chief axes compressed, 1-3 mm. diam.; cystocarps forming single or seriate subspherical swellings in the branchlets.

Previously reported from Brazil, but ill known in American waters.

VENEZUELA: Cubagua Island, occasional on rocks in shallow water along the beach, *no.* 39-457, 14 April 1939.

## Rhodymeniaceae

Plants filiform to commonly fleshy-membranous and sometimes hollow; with a modified multiaxial type of development, but structurally pseudoparenchymatous; asexual reproduction by tetrapartite sporangia formed just below the surface; carpogenic branch of three cells, the auxiliary borne upon the same supporting cell beside the carpogonium; cystocarp with a loose pericarp, discharging by a pore.

### KEY TO GENERA

1. Plant with slender axis and pyriform to spherical hollow branchlets . . . . . *Botryocladia*
1. Plant without specialized branchlets . . . . . 2
2. Plant segmented, the segments hollow . . . . . *Coelarthrum*
2. Plant not segmented . . . . . 3
3. Plant more or less hollow . . . . . *Chrysomenia*
3. Plant solid . . . . . 4
4. No filamentous tissue about the carpospores . . . . . 5

4. Filamentous tissue between carpospores and pericarp wall  
   . . . . . Leptofauchea
5. Thallus foliaceous . . . . . Cryptarachne
5. Thallus peltate, round or radiately lobed, or subfoliaceous  
   and irregularly lobed . . . . . Fauchea

### FAUCHEA Bory et Montagne, 1846

#### *Fauchea peltata* n. sp.<sup>9</sup>

Plate 3, Fig. 9; Plate 16, Figs. 1-5

Plant growing appressed to the substratum and attached by a short stalk, 1-5 cm. broad, 0.5-1.0 cm. tall; short stipitate, perfoliate or stipe marginal; disk or blade irregularly rounded, crenate, or digitately lobed, the lobes rarely secondarily divided; fleshy, increasing in thickness from the margin, which is about 200  $\mu$  thick, toward the base of the stipe; structurally showing a medulla of very large colorless cells about 175  $\mu$  diam., with about one layer of somewhat smaller cells on each side, and a cortex of two cell layers, the inner of fairly closely approximated rounded cells about 6-10  $\mu$  diam., the outer of smaller round cells 4.0-5.5  $\mu$  diam., separated in surface view by 1-5 times their own diameters; reproductive structures unknown.

VENEZUELA: Tortuga Island, dredged at 38-40 meters' depth on a bottom of dead coral, sta. A44, no. 39-559, 21 April 1939.

This species seems closely related to *Fauchea Hassleri* Howe & Taylor (1931, p. 13). That species proves, on re-examination, to be more or less spreading-repent, because on at least one piece secondary haptera were developed on distal branches and fragments of coral attached. The present plant showed, on one old, irregularly branched piece in particular, a number of such secondary haptera, both marginal and on the lower face of the blades. The present species shows a less extensive filamentous outer cortex. It is commonly peltate, a condition not observed in *F. Hassleri*, and even in nonpeltate specimens was more irregularly and less extensively branched. A very broad-lobed specimen (Hassler 1034 *p.p.*?), identified by M. A. Howe for the writer from the same

<sup>9</sup> *Fauchea peltata*—Planta substrato adpressa, plerumque in rima saxi affixa, perfoliata aut marginaliter breve stipitata, disco rotundato, crenato aut digitatolobato, carnosio, a circa 200  $\mu$  crassitudine juxta marginem, versus basim stipitis augente; structura interiore cellularum magnarum sine colore, exteriori cellularum minorum, strato superficiali cellulis paululum confertis, sed corio superficiali e cellulis parvis atque late dispersis, gelatina satis crassa inclusis. Planta typica in loco dicto Tortuga Island, no. 39-559, 21 April 1939.

expedition, was reported (Taylor 1933) as *Chrysomenia planifrons*, but it has a submarginal holdfast and the structure of *F. peltata*, of which it seemingly represents a large (9 cm. wide) specimen.

### LEPTOFAUCHEA Kylin, 1931

Thallus solid, flat, regularly dichotomous; medulla of large cells without intermixed rhizoids; cortex of a single layer of small cells; cystocarps without spines; sporangia unknown.

#### *Leptofauchea rhodymenioides* n. sp.<sup>10</sup>

Plate 3, Figs. 7, 8; Plate 17, Figs. 1, 2

Plant to 6 cm. tall (perhaps more), moderately branched, deep rose pink in color, very slightly glossy when dried; holdfast somewhat lobed, stipe ill defined; axis rather evenly 3-5 times (or more?) dichotomously branched, diverging 60°-90°, rarely more; the divisions 1.0-1.5 cm. apart, 4-8 mm. broad above the forks, not much wider below them; apices broadly rounded; tetrasporangial sori appearing as irregular bands nearly as wide as the branch, to 4 mm. long, darker in color and duller than the vegetative portion, consisting of slender paraphysal filaments 6-8 cells or about 75-100  $\mu$  long, 4.5  $\mu$  diam., laterally bearing oval tetrapartite sporangia 51-77  $\mu$  long, 28-46  $\mu$  diam., attached to the second or third cell from the base; pericarps prominent, marginal, to 1.0-1.5 mm. diam.

NETHERLANDS WEST INDIES: Aruba Island, dredged at 43 meters' depth from a bottom of sand and coralline algae at sta. A18, no. 39-351, 10 April 1939.

Structurally this plant shows a medulla of very large thin-walled cells about 60-140  $\mu$  diam., irregularly in 2-3 layers, occupying about four fifths of the thickness, with one layer of similar but considerably smaller cells on each side below the surface layers. There is one continuous surface layer, the cells 9-21  $\mu$  diam., and outside of it widely scattered cells, hardly forming a true layer, which are 3.5-6.0  $\mu$  diam. The entire thickness of the blade in the upper, sterile region is about 200  $\mu$ .

<sup>10</sup> *Leptofauchea rhodymenioides*—Planta usque ad 6 cm. aut altior, stipite male definito, supra complanata et satis dichotome furcata, angulis 60°-90°, intervallis 1.0-1.5 cm., ramis 4-8 mm. latitudine, apicibus late rotundatis; soris tetrasporangiferis taenias irregulares paene trans ramos, usque ad 4 mm. longitudine, efficientibus; filamentis paraphysalibus 75-100  $\mu$  longitudine, e 6-8 cellulis, circa 4.5  $\mu$  diam., in cellula secunda aut tertia a basi sporangia ovata, tetrapartita, 51-77  $\mu$  long., 28-46  $\mu$  diam. ferentibus; pericarpis prominentibus marginalibusque. Planta typica in loco dicto Aruba Island, Netherlands West Indies, no. 39-351, 10 April 1939.

The pericarp is of loose, more or less stellate cells within, but with a thin, firmer outer layer and an evident pore. The carpospores in the mature cystocarp are lightly attached in groups, to the base of the pericarp, without recognizable central sterile tissue. From Kylin's genus description these plants differ in having superficial scattered cells over the continuous cortical layer, and in having tetrasporangia attached to paraphyses in sori; they were absent from his material.

### CHRYSYMENIA J. Agardh, 1842

Thallus soft, cylindrical or compressed, hollow, radially irregularly branched; structurally with large cortical cells within, associated with gland cells, and outwardly with 1-3 layers of small assimilatory cortical cells; tetrasporangia scattered at the surface of the cortex.

#### KEY TO SPECIES

1. Branches cylindrical, irregularly alternately disposed . *C. ventricosa*
1. Branches flattened, essentially dichotomous . . . *C. halymenioides*

#### *Chrysymenia ventricosa* (Lamouroux) J. Agardh

Plant to 15 cm. tall, branches small near the tips, larger near the base of the plant, the older ones a little constricted at the base, radial or in part vaguely bilaterally disposed, commonly 2-5 mm. diam.

Kützinger 1866, p. 31, pl. 86c-e as *Halymenia ventricosa*; Børgesen 1915-20, p. 395, fig. 378.

Previously known from the American tropics only by Børgesen's report of its occurrence at the Virgin Islands; it probably is a plant of deep water.

VENEZUELA: Tortuga Island, one good specimen thrown ashore on Punta Arenas, no. 39-373, 13 April 1939.

#### *Chrysymenia halymenioides* Harvey

Plant to 10 cm. tall, very soft in texture, the branches dichotomous, formed at angles of 80°-120°, flat, 6-12 mm. wide, not greatly tapered upwardly, the apices obtuse.

Harvey 1853, p. 188, pl. 20, figs. A1-8.

NETHERLANDS WEST INDIES: Dredged at sta. A18 near Aruba Island, a few small fragments, at 43 meters' depth from a bottom of sand and coralline algae, no. 39-349, 10 April 1939.

**CRYPTARACHNE** Kylin, 1931**Cryptarachne planifrons** (Melvill) Kylin

Plant with a small holdfast and a stipe some 5 mm. long or less, foliaceous above, the base obtuse to transverse, spreading into a moderately thick broadly ovate blade which reaches 25 cm. in width, 35 cm. in length, and may be entire or somewhat lobed, with an irregularly, very coarsely dentate margin; inner cortical tissue of large cells, associated with small gland cells, and with scanty delicate filaments in the medullary position; outer cortex of 1-3 layers of small assimilatory cells; tetrasporangia scattered at the surface of the thallus.

Kylin 1931, p. 12; Børgesen 1915-20, p. 394, fig. 377.

Previously reported from Florida, the Virgin Islands, and Brazil.

NETHERLANDS WEST INDIES: Dredged from 43 meters' depth off a bottom of sand and coralline algae from sta. A18 near Aruba Island, no. 39-345, 10 April 1939. One piece only was secured, and in immature condition, so that the determination is not quite conclusive.

**COELARTHURUM** Børgesen, 1910**Coelarthrum Albertisii** (Piccone) Børgesen

Plate 18, Fig. 1

Plant bushy, to 5 cm. tall, terete, segmented, hollow but with septa at the constrictions, and segments swollen in the middle, oval to spherical or triangular, to 5 mm. diam., each segment tending to bear two distal branches, so that the branching is dichotomous.

Børgesen 1915-20, p. 404, figs. 389-391.

Previously reported only from the Virgin Islands within our area; probably a plant of deep water.

VENEZUELA: Tortuga Island, rare as washed ashore on Punta Arenas, no. 39-405, 13 April 1939.

**BOTRYOCLADIA** Kylin, 1931

Plant with a terete, wiry, generally branching stem which bears oval to spherical hollow vesicular branchlets; vesicles with large colorless cells inside associated with gland cells, smaller cells with chromatophores outside; sporangia scattered at the surface of the vesicles, tetrapartite.

**KEY TO SPECIES**

1. Plants large, to 2.5 dm. tall; vesicular branches many, distributed along somewhat dichotomous axes; gland cells solitary . . . . . *B. occidentalis*



1. Plants small, less than 5 cm. tall; vesicular branches few, the axes short and little branched; gland cells in clusters . . .  
 . . . . . B. *pyriformis*

***Botryocladia occidentalis* (Børgesen) Kylin**

Harvey 1853, p. 191, pl. 20B; Børgesen 1915-20, p. 402, fig. 388; Taylor 1928, p. 160, pl. 22, fig. 13, pl. 23, fig. 15 (all as *Chrysymenia Uvaria*); Kylin 1931, p. 18.

A fairly common plant in moderately deep water in the American tropics, reported from Bermuda and North Carolina to Brazil.

COLOMBIA: Occasional as dredged at 24 meters' depth from a bottom of gray sand at sta. A13 near Cape LaVela, no. 39-269, 8 April 1939.

***Botryocladia pyriformis* (Børgesen) Kylin**

Børgesen 1915-20, p. 400, figs. 384-387; Taylor 1928, p. 159, pl. 22, fig. 14, pl. 23, figs. 14, 16, 17, 20 (both as *Chrysymenia pyriformis*); Kylin 1931, p. 18.

Previously known from Bermuda, Florida, the Virgin Islands, and Brazil. Probably widely distributed in moderately deep water, growing on broken corals; but, as it is inconspicuous, it is probably generally overlooked, or mistaken for a poorly developed state of the preceding.

NETHERLANDS WEST INDIES: Rare as dredged from 43 meters' depth off a bottom of sand and coralline algae at sta. A18 near Aruba Island, no. 39-359, 10 April 1939.

The specimens secured in this collection were altogether remarkable, because the vesicles were so large. In this species solitary or subsolitary vesicles are not unusual, and the vesicles are often nearly a centimeter long; in one of these the vesicle was obovate, 5 cm. long and 4 cm. diam., but structurally like others of this species.

## Champiaceae

Plants usually bushy, branches cylindrical or compressed, delicately membranous, or somewhat firm in the older portions; developing from an apical meristem with a cortex of small cells without, large cells within, and a cavity traversed by longitudinal medullary filaments which bear lateral secretory cells; tetrahedral sporangia formed just below the surface of the sporangial plants; spermatangia formed by the surface cells of the male plants; carpogenic branches three- or four-celled, the auxil-

iary secondarily derived from the same supporting cell as the carpogenic branch; carpospores discharged from a prominent ostiolate pericarp.

### CHAMPIA Desvaux, 1808

#### *Champia parvula* (C. Agardh) Harvey

Plant densely tufted, pale, dull red or greenish, crisply gelatinous in texture, to 3-7 cm. tall, alternately branched, the branches 1-2 mm. diam., tapering, segmented, the nodes with a septum and the segments inflated; tetrasporangia scattered at the surface of the segments.

Taylor 1937, p. 310, pl. 43, figs. 8-10.

A common plant growing on coarser algae and phanerogams in shallow protected water; it is known from temperate waters through the American tropics to Brazil. It is smaller in the tropics than in Massachusetts.

VENEZUELA: Dredged from 3.5 meters off a bottom where algae were rather abundant, sta. A28 near Cubagua Island, no. 39-484, 15 April 1939.

### Ceramiaceae

Plants usually bushy, filamentous branches uniseriate or corticated; cortex if present developed from nodal segments of the persistent axial row, remaining limited or spreading over the internode in filamentous fashion, or becoming parenchymatous; sporangia superficial or stalked, sometimes immersed in the nodal cortication, tetrapartite or tetrahedral or occasionally developing polyspores; spermatangia developed on special determinate colorless branchlets, more or less in clusters; carpogenic branches of four cells upon a supporting cell which produces one or more sterile cells and auxiliaries near the carpogonium; cystocarp naked or immersed in a jelly, or partly surrounded by involucre cells or filaments, of one or more groups of gonimoblasts with the outer cells producing the carpospores.

#### KEY TO GENERA

1. Evidently segmented, the oval to spherical coenocytic segments visible to the naked eye . . . . . *Griffithsia*
1. Segmentation of the axis obscure, the segments, if large, covered by corticating cells . . . . . 2
2. Uncorticated, or with rhizoidal cortication . . . . . 3

2. Corticated by outgrowth from the nodes . . . . . 5
3. Branching generally opposite; carpogenic branches subterminal; tetrasporangia short-stalked, near the bases of the branchlets . . . . . *Spermothamnion*
3. Branching of various types; carpogenic branches lateral . . 4
4. Main axis usually obscure above; none of the branching verticillate; tetrasporangia naked . . . . . *Callithamnion*
4. Main axis evident, the apical cell persistent; branchlets verticillate upon the axis; tetrasporangia involucrate . . . *Wrangelia*
5. Cortication of the branchlets similar to that of the main axis . . . . . 6
5. Cortication of the branchlets limited to a row of cells about the nodes, while that of the main axes covers the internodes . . . . . *Spyridia*
6. Cortication by regular longitudinal rows of rectangular cells . . . . . *Centroceras*
6. Cortication of irregular rows of cells, or apparently parenchymatous . . . . . *Ceramium*

### CALLITHAMNION Lyngbye, 1819

#### *Callithamnion Halliae* Collins

Plant to 5 cm. tall, usually with a percurrent axis, straight below, flexuous above, to 200  $\mu$  diam. at the base, uncorticated; branching alternate to one or two degrees, and then dichotomous to the ultimate divisions; undivided branchlets of one to several cells in length, 10 to 20  $\mu$  diam., little tapered, rather obtuse at the tips; cells sometimes 1-2, more generally 4 diameters long; sporangia tetrahedral, sessile on the upper side of the ultimate branchlets, often single at each joint; cystocarps at the forks of the lateral branches, or on the side of the main filament; spermatangia tufted on the upper side of the branchlets.

Collins, Holden and Setchell, Phyc. Bor.-Amer., no. 698, 1896; Collins 1906, p. 111; Collins and Hervey 1917, p. 136.

Known from Bermuda and Florida to Guadeloupe, but seldom reported. It is an epiphyte, of moderately shallow water.

NETHERLANDS WEST INDIES: Curaçao Island, common on *Acanthophora* about the shore of Valentijn's Bai, Willemstad, coll. F. H. Elmore, no. 39-579, 23 April 1939.

**WRANGELIA C. Agardh, 1828****Wrangelia Argus Montagne**

Plants erect and bushy, commonly forming an exceedingly soft turf; filiform, the main branches of an axial cell row lightly corticated by rhizoidal downgrowths in the lower part of the plant; branchlets verticillate on the axes, subdivided more or less dichotomously, the terminal long attenuate, or mucronate, or the tips deciduous; tetrahedral sporangia formed at the nodes, closely surrounded by a few involucreal filaments.

Børgesen 1915-20, p. 116, figs. 125, 126; Taylor 1928, p. 114, pl. 20, fig. 13, pl. 22, fig. 6, pl. 32, fig. 4.

Common in American tropical waters, growing on rocks and calcareous algae exposed by receding waves and consequently in exposed situations, often forming a more or less continuous carpet; it has been reported from the Bahamas and Florida to Trinidad.

PANAMA: Caledonia Harbor, common on larger, calcareous algae upon rocks in shallow water near Isla Piedra and I. San Augustin, *no.* 39-235, 4 April 1939. NETHERLANDS WEST INDIES: Curaçao Island, common on rocks along the shore, Jan Thiel Beach, *no.* 39-596, 23 April 1939.

**SPERMOTHAMNION Areschoug, 1877**

Plant tufted, the basal part stoloniferous, attaching by disciform holdfasts, uniseriate, the erect filaments oppositely or unilaterally branched; sporangia tetrahedral, stalked, solitary or clustered near the bases of the branchlets; spermatangia forming clusters on the upper side of the branchlets; carpogenic branches formed on the tips of lateral or terminal branchlets, of four cells, the two auxiliaries being formed after fertilization from pericentral cells of the small node which produced the carpogenic branch; cystocarps often surrounded by small branchlets.

**KEY TO SPECIES**

1. Minute plants growing on *Codium*, the basal portion extensive, cells 30-45  $\mu$  diam., with holdfasts at nearly every cell; erect portion of short filaments 1-2 mm. tall, generally with one, occasionally to 3 or 4 unilateral branches; cells 22-28  $\mu$  diam., 3-8 diameters long; tetrasporangia on short stalks, solitary, occasionally opposite, at the bases of the erect filaments, or the stalks once branched; sporangia developing polyspores, 85-105  $\mu$  diam., 105-125  $\mu$  long . . . . . *S. gorgoneum*

1. Small, but larger plants growing on rocks, the prostrate filaments larger, to  $65\ \mu$  diam.; erect filaments to 5-8 mm. long, about  $50\ \mu$  diam. near the base, decreasing upward, the cells 5-20 diameters long; branching sparse, seemingly dichotomous; tetrasporangia on a short branch, sometimes two such branches developed at a node, and these divided to two or three; sporangia  $50-55\ \mu$  diam. . . . . *S. macromeres*

***Spermothamnion gorgoneum* (Montagne) Bornet**

Plate 4, Figs. 1-4

Børgesen 1925-30, (III, iii) p. 15, fig. 4.

Several times reported, and probably common, though inconspicuous, as an epiphytic or epizoid plant. The stations known range from Bermuda to Barbados.

BRITISH WEST INDIES: Tobago Island, in considerable amount on one small piece of *Codium*, Buccoo Bay, no. 39-534*b* in part, 20 April 1941.

***Spermothamnion macromeres* Collins and Hervey**

Collins and Hervey 1917, p. 132; Collins, Holden, and Setchell, Phyc. Bor.-Amer., no. 2044.

Previously only known from the Bermuda and Bahama Islands. This is a plant which grows attached to rocks in shallow water, so that it is uncovered at low tide, but protected by being mixed with sand.

NETHERLANDS WEST INDIES: Curaçao Island, rare on rocks along the shore of Valentijn's Bai, Willemstad, collected by F. H. Elmore, no. 39-581, 23 April 1939.

**GRIFFITHSIA C. Agardh, 1817**

***Griffithsia globulifera* Harvey**

Plants erect and bushy, to 4.0-6.5 cm. tall, from a fibrous holdfast, the branching chiefly falsely dichotomous, the branches moniliform, the texture gelatinous; segments consisting of single coenocytes which are clavate to subspherical, 0.6-3.2 mm. long, 0.2-1.5 mm. diam., not corticated or with a few rhizoidal filaments about the base; sporangia tetrahedral, forming a band around a fertile node, and partly surrounded by sausage-shaped involucre cells; spermatangia forming a cap over the subspherical terminal cell of a fertile branch; cystocarps lateral at a fertile node, and partly surrounded by involucre cells.



Taylor 1937, p. 327, pl. 43, figs. 1-4.

In warm temperate regions common in protected situations, growing in moderately shallow water on stones or coarser plants; not so common or so large in the tropics, though found in similar situations from Bermuda and Florida to Barbados.

VENEZUELA: Tortuga Island, frequent tetrasporic plants washed ashore on Punta Arenas, no. 39-389, 13 April 1939.

### CERAMIIUM Wiggers, 1817

Plants erect and bushy, or matted, branching dichotomous or pinnate, the segmented branches with a uniseriate axis of large cells corticated at the nodes by smaller cells, from which zones cortication may spread to more or less completely cover the internodes; sporangia tetrahedral, sessile, borne at the nodes or immersed more or less completely in the internodal cortication; spermatangia forming a layer on the fertile nodes; carpogenic branches four-celled, the supporting cell cutting off an auxiliary after fertilization from which the gonimoblasts are produced, the carpospore mass in some species more or less completely surrounded by a few involuclral branchlets.

### KEY TO SPECIES

1. Branching dichotomous at least in part . . . . . 2
1. Branching alternate and complanate, closely subdivided, the terminal segments acute and divergent; internodes naked and conspicuous, twice as long as broad; tetrasporangia verticillate in the penultimate branchlets, prominent and naked above . . . . . *C. floridanum*
2. Nodal cortication showing notably large cells along the lower border of the band, but these irregularly subdivided in very old nodes; filaments to 120-130  $\mu$  diam. below, the nodes shorter than broad, the internodes to 10 times as long as broad; tetrasporangia partly surrounded from below by the cells of the node, about 60  $\mu$  diam.; branching chiefly alternate below, dichotomous above . . . . . *C. subtile*
2. Nodal cortication showing a notable series of transversely elongated cells in the lower portion of each band; filaments 60-80  $\mu$  diam., the branches spreading; lower internodes 6-8 times as long as broad; tetrasporangia emergent, inflating the lower portions of the nodal band; branching chiefly dichotomous . . . . . *C. byssoideum*

***Ceramium subtile* J. Agardh**

Taylor 1928, p. 192, pl. 27, figs. 17-19.

Reported from Florida and the Bahamas to Barbados, this is a rather common tropical species in warm, protected shallow water.

NETHERLANDS WEST INDIES: Curaçao Island, rare and mixed with other small forms on rocks, Valentijn's Bai, Willemstad, coll. F. H. Elmore, no. 39-581 in part, 23 April 1939.

***Ceramium byssoideum* Harvey**

Harvey 1853, p. 218; Taylor 1928, p. 190, pl. 27, figs. 20, 21.

Reported from Bermuda and Florida to Venezuela, this plant is most commonly found entangled in other coarser algae in moderately shallow water.

VENEZUELA: Tortuga Island, frequent on Hypnea, etc., on Punta Arenas, no. 39-392b, 13 April 1939.

***Ceramium floridanum* J. Agardh**

Agardh, J., 1894, p. 46.

Previously only known from Florida and Trinidad, this species while small is the most beautiful of the genus in eastern American waters and appears to be an epiphyte upon coarser algae.

VENEZUELA: Tortuga Island, rare as an epiphyte on Grateloupia from driftweed washed ashore on the beach, Punta Arenas, no. 39-420, 13 April 1939; Cubagua Island, uncommon, no. 39-456, 14 April 1939.

**CENTROCERAS Kützing, 1842*****Centroceras clavulatum* (C. Agardh) Montagne**

Plants forming close turfs, or looser clumps, filamentous, branching unequally dichotomous, apices of the branches forcipate; filaments 50-75  $\mu$  diam., with a central axis of large cells surrounded by a very regular cortex of longitudinally seriate rectangular cells; nodes with numerous prominent, usually two-celled spines; tetrasporangia verticillate in the terminal segments of axillary torulose proliferations.

Børgesen 1915-20, p. 241; Taylor 1928, p. 189, pl. 28, figs. 6, 7.

A very common plant throughout the American tropical area, chiefly found in shallow water where in the intertidal zone it may form a short dense turf near low-tide line or, in deep tide pools or over the side of reefs, larger more or less loose masses. It has been reported from Bermuda

and Florida to Brazil. Because of its considerable variability a number of names have been assigned, but the segregations have not proved useful.

VENEZUELA: Tortuga Island, infrequent with *Bryothamnion* as washed ashore on Punta Arenas, *no. 39-392a*, 13 April 1939; Cubagua Island, frequent on rocks and ledges along the sandy beach, *no. 39-472*, 14, 15 April 1939. NETHERLANDS WEST INDIES: Aruba Island, common but usually dwarfed and sand covered, on the rocks along the shore of the cove at Punta Basora, *no. 39-312a*, 10 April 1939; Curaçao Island, from massive broken corals along the shore, Jan Thiel Beach, *no. 39-603*, 23 April 1939. BRITISH WEST INDIES: Tobago Island, with *Gelidium* and *Gelidiella* on rocks of the outer reef, and sand covered in more protected areas, Buccoo Bay, *nos. 39-537, 39-558b*, 20 April 1939.

### SPYRIDIA Harvey, 1833

Plant forming erect, bushy masses, much alternately or irregularly branched, the branches corticated by transverse series of longitudinally elongate cells, which eventually become subdivided and covered by rhizoidal downgrowths; ultimate branchlets of limited growth, consisting of a uniseriate axis bearing rings of small cells at the nodes, but the internodes long and translucent, the terminal and sometimes the lower nodes armed with a spine; sporangia tetrahedral, seriate on the upper side of the branchlets; spermatangia on the nodes of the branchlets; cystocarps surrounded by slender filaments at the tips of small branchlets.

#### KEY TO SPECIES

1. Branchlets without lateral spines at the upper nodes . . . 2
1. Branchlets with one or more recurved spines on the upper nodes (often difficult to detect except on the youngest branchlets); the branch tips often swollen and uncinatate . . . *S. aculeata*
2. Branch tips blunt, commonly with few or small branchlets, distinctly clavate . . . . . *S. clavata*
2. Branch tips tapered, sometimes recurved or tendriform, but not swollen . . . . . *S. filamentosa*

#### *Spyridia filamentosa* (Wulfen) Harvey

Børgesen 1915-20, p. 233, figs. 222-226; Taylor 1927, p. 197, pl. 28, figs. 4, 18.

A common species of warm temperate and tropical American waters, growing in quiet, shallow water on stones and old shells, corals, etc. It is known from Bermuda and North Carolina to Brazil.

PANAMA: Caledonia Harbor, rare on rocks in shallow water near Isla Piedra and I. San Augustin, *no. 39-171*, 3 April 1939; dredged at 2-13 meters' depth off a bottom of mud and fine sand at sta. A2, Caledonia Harbor, *no. 39-213*, 3 April 1939. COLOMBIA: Fragment dredged from 24 meters' depth off a bottom of gray sand at sta. A13 near Cape LaVela, *no. 39-264*, 8 April 1939; rare, fragment dredged at 14-16 meters off a bottom with coralline algae at sta. A15 near Bahia Honda, *no. 39-299*, 8 April 1939. NETHERLANDS WEST INDIES: Curaçao Island, infrequent along the shore of Valentijn's Bai, Willemstad, collected by F. H. Elmore, *no. 39-580*, 23 April 1939.

### *Spyridia clavata* Kützting

Børgeesen 1915-20, p. 235, fig. 227.

Infrequently reported from the American tropics, this plant is known from North Carolina to Barbados. Apparently it, also, is a plant of quiet shallow waters.

BRITISH WEST INDIES: Tobago Island, rare as washed ashore in Rockly Bay, *no. 39-494*, 18-20 April 1939; occasional as washed ashore in Buccoo Bay, *no. 39-519*, 20 April 1939.

### *Spyridia aculeata* (Schimper) Kützting

Børgeesen 1915-20, p. 237, figs. 228-230; Taylor 1928, p. 196, pl. 28, figs. 5, 17; pl. 33, fig. 8.

Probably the commonest member of the genus in the West Indian area, this plant is known from Bermuda and Florida to Brazil. It is found in shallow water, even to the lower part of the intertidal zone, where it may form large clumps in tide pools, or dense turfs on exposed and wave-beaten rocks. Old and partly denuded or diatom-covered specimens are not at all easy to distinguish from *S. filamentosa*, if there are no hooked tips in evidence, or if, as in *f. inermis*, they are generally lacking.

VENEZUELA: Tortuga Island, abundant on rocks along the shore of Punta Arenas, *no. 39-408a*, 13 April 1939; Cubagua Island, small plants frequent on the scattered rocks along the beach, *no. 39-454*, 14 April 1939. NETHERLANDS WEST INDIES: Aruba Island, infrequent tufts on larger algae, near the shore of the cove at Punta Basora, *no. 39-320*, 10 April 1939. These specimens in part showed the characters of *f. disticha* Børgeesen (1915-20, p. 238, fig. 229).

f. *inermis* Børgesen

Børgesen 1915-20, p. 239, fig. 230.

NETHERLANDS WEST INDIES: Curaçao Island, frequent and densely tufted on the rocks in shallow water along the shore, Jan Thiel Beach, no. 39-604, 23 April 1939.

**Delesseriaceae**

Plants usually foliaceous, simple or somewhat alternately branched and bushy, the branches usually delicately membranous; growth from an apical cell which produces an axial row, and lateral cell rows of several degrees, to form the membrane which may be one cell thick or corticated; sporangia tetrahedral, usually in superficial sori; spermatangia in sori; two four-celled carpogenic branches borne together on a special segment from the supporting cell, which develops the auxiliary cells after fertilization, or one carpogenic branch is suppressed; cystocarp with a central fusion cell, the outer cells of the gonimoblasts forming carpospores, discharged through the ostiole of the thin inflated pericarp.

**KEY TO GENERA**

1. Thallus without veins . . . . . Nitophyllum
1. Thallus with a prominent midrib, at least below . . . . 2
2. Plant unbranched, the single rosy pink blade large . . . Grinnellia
2. Plant branched from the midrib, pale greenish or pinkish,  
from deeper water . . . . . Hypoglossum

**HYPOGLOSSUM** Kützinger, 1843***Hypoglossum tenuifolium*** (Harvey) J. Agardh

Plate 18, Fig. 2

Plant bushy, pale green or slightly pinkish, formed of blades with a strong midrib and a lamina one cell in thickness, branching from the midrib; tetrasporangial sori small, pink, single on each side of the midrib, somewhat elongated and encroaching on the midrib; pericarps elevated, single on a blade, upon the midrib; spermatangial sori small, at intervals on each side of the midrib.

Harvey 1853, p. 97, pl. 22B, figs. 1-4; Børgesen 1915-20, p. 344, figs. 340-343 (both as *Delesseria tenuifolia*); Taylor 1928, p. 162, pl. 24, figs. 10-13 (as *D. Hypoglossum*); Kylin 1924, p. 9.



This is a plant of moderately deep water, but unlike many Rhodophyceae of deep water, is generally, perhaps always, pale greenish and does not develop a pink color when drying, or does so only around some of the younger blades; the spores are, however, pink. It has been reported from Bermuda and South Carolina to Venezuela.

VENEZUELA: Tortuga Island, common as washed ashore on Punta Arenas, no. 39-388, 13 April 1939.

### GRINNELLIA Harvey, 1853

*Grinnellia americana* (C. Agardh) Harvey, var. *caribaea* n. var.<sup>11</sup>

Plant a large, erect, simple translucent pink blade; a prominent midrib in the lower part, which is broadly ovate to cordate; tetrasporangia in small round sori 0.20-0.37 mm. diam. scattered evenly over the blade; cystocarps similarly scattered, less numerous and much larger, strongly swollen, the pericarps to 1.0-1.5 mm. diam.; spermatangia not seen in Caribbean material, in this genus usually in small more or less confluent sori on very small blades.

Taylor 1937, p. 352, pl. 30, figs. 4-7, pl. 42, fig. 2, pl. 59, fig. 8 (typical material of the species).

NETHERLANDS WEST INDIES: Dredged from 43 meters' depth off a bottom of sand and coralline algae at sta. A18 near Aruba Island, no. 39-344, 10 April 1939. VENEZUELA: Cubagua Island, rare fragments washed ashore, no. 39-441, 14 April 1939.

The question at once develops as to the relationship of these plants to *G. americana* of northern waters. That species has been reported from North and South Carolina and from the West Indies, but without detailed location in the latter case. It is abundant in Long Island Sound and adjacent waters, but not north of Cape Cod. At first one is inclined to accept the tropical as identical with the northern plant, but one should not disregard certain apparent differences. The plants seem to be shorter and broader, even when young; the midrib does not extend as far up the blade, perhaps only halfway. The tetrasporangia are in round rather than longitudinally elongate sori, and these are much more numerous and much smaller than usual on blades of the same size in northern plants.

<sup>11</sup> *Grinnellia americana* var. *caribaea*—Planta laminas latas, simplices, brevique stipitatas, a late ovatis ad cordatas deorsum variantis, formans, costa media solum parte in inferiore laminae praeditas, venulis lateralibus autem nullis; soris tetrasporangiferis non aggregatis, 0.20-0.37 mm. diam.; pericarpis non aggregatis, 1.0-1.5 mm. diam. Planta typica in loco dicto Aruba Island, Netherlands West Indies, no. 39-344, 10 April 1939.

However, in the north there is a good deal of variation in shape of the blade and strength of the midrib; likewise the tetrasporangial sori are sometimes irregular in form and, when seen in very small, young blades, more or less round. For blades of comparable size, the differences do seem to hold good. On the tetrasporic blade studied closely there were about 100-120 sori per square centimeter, and these were about 0.2-0.37 mm. diam., while in Massachusetts specimens the sori became as much as 1 mm. wide and 3 mm. long, though usually much smaller, and were fewer per square centimeter, perhaps about half as many, and when very large a score or less. On the other hand, the older pericarps of the tropical material were as large as 1.0-1.5 mm. diam., about twice the size of those on the northern specimens. All of the specimens secured were either young and small or fragmentary, so that the statement of shape must be regarded as tentative.

### NITOPHYLLUM Greville, 1830

Plant forming delicate flat membranous blades, dichotomously or sub-palmately forked or lobed, lacking any veins, monostromatic except in the older or the fruiting parts, without cross-dividing apical cells except on juvenile plants and proliferations; cystocarps scattered, with the carpospores generally single on the ends of the gonimoblasts; spermatangia in elongated sori; tetrasporangia in evident rounded sori.

#### *Nitophyllum punctatum* (Stackhouse) Greville

NETHERLANDS WEST INDIES: Aruba Island, occasional fragments dredged from 43 meters' depth off a bottom of sand and coralline algae at sta. A18, no. 39-346, 10 April 1939. VENEZUELA: Tortuga Island, fragments dredged from 38-40 meters' depth off a bottom of dead coral fragments at sta. A44, no. 39-562a, 21 April 1939.

The small tetrasporic fragments composing the Venezuelan material are much more narrowly segmented than the specimen from Florida (no. 747) in the Phycotheca Boreali-Americana. The pieces secured near Aruba Island were some of them broad and barely lobed, some narrow, strap shaped, and branching; one small bit showed cystocarps and permitted verification of the carpospore arrangement. The species is very variable in form, and as the var. *ocellatum* (Lamouroux) J. Agardh it has been reported from Florida and the American tropics, but on very few occasions.

## Dasyaceae

Plants usually bushy, the main branches bearing monosiphonous branched filaments of limited growth which may remain free or be united into a network; axes in some genera corticated by the development of a circle of pericentral cells, and also by rhizoidal filaments which grow down from the bases of the branchlets; monosiphonous branched filaments sometimes corticated at the very base, and terminating in colorless hairs; sporangia produced in special stichidia, tetrahedral; spermatangia borne in clusters on special lateral branchlets; four-celled carpogenic branches formed near the bases of the branched filaments, with an auxiliary associated with certain sterile cells formed from the same supporting cell.

### DASYA C. Agardh, 1824

#### *Dasya pedicellata* (C. Agardh) C. Agardh

Plant from a disklike holdfast, erect to 2-6 dm. tall, reddish purple, sparingly alternately branched, branches densely covered with dichotomously branched monosiphonous chromatophore-bearing filaments irregularly placed; stichidia lanceolate to linear-lanceolate; spermatangial clusters lanceolate to linear-lanceolate, usually filament-tipped; pericarps stalked, urceolate, with a narrow ostiolate neck.

Taylor 1928, p. 173, pl. 35, fig. 7; 1937, p. 355, pl. 54, figs. 1-4.

A plant, of shallow water in the north, though more often dredged in the tropics, reported from northern shores and from Bermuda and North Carolina to the Virgin Islands.

NETHERLANDS WEST INDIES: Curaçao Island, common along the shore of Valentijn's Bai, Willemstad, coll. F. H. Elmore, no. 39-578, 23 April 1939; dredged from 43 meters' depth off a bottom of sand and coralline algae at sta. A18 near Aruba Island, no. 39-350, 20 April 1939.

VENEZUELA: Tortuga Island, rare as washed ashore on Punta Arenas, no. 39-386, 13 April 1939; Cubagua Island, rare along the beach on rocks, no. 39-451, 14 April 1939.

## Rhodomelaceae

Plants usually bushy, generally filamentous but sometimes membranous; growth from an apical cell, the axial row surrounded by pericentral cells and sometimes these in turn by a more or less irregular cortex; spo-

rangia from segments formed on the inner side of the pericentral cells, tetrahedrally divided, the branches usually little modified but sometimes somewhat stichidiumlike; spermatangial clusters developed from trichoblast rudiments; carpogenic branches four-celled, produced on a pericentral cell associated with certain sterile groups and an auxiliary formed after fertilization; carpospores formed from the outer cells of the gonimoblasts, which are borne on a large fusion cell, and discharged through the ostiole of the prominent pericarp.

### KEY TO GENERA

1. Branches flat . . . . . 2
1. Branches cylindrical . . . . . 5
2. Membranous, the growing point generally exposed . . 3
2. Cartilaginous, the growing point sunken in the branch tip *Laurencia*
3. Branch tips inrolled, branches delicately membranous . *Amansia*
3. Branch tips flat, or nearly so . . . . . 4
4. Branch apices acute, branching irregular, the divisions lanceolate, without well-marked costa . . . . . *Cladhymenia*
4. Branch tips broadly rounded, branching pinnate, the strap-shaped branches becoming serrate, coarsely membranous, with prominent costa . . . . . *Vidalia*
5. Ultimate branches more or less coarse and cartilaginous . 6
5. Ultimate branches filamentous . . . . . 10
6. Plant beset with spinelike branchlets . . . . . 7
6. Not spinulose . . . . . 9
7. Branches angular-compressed, sometimes flattened . *Bryothamnion*
7. Branches cylindrical . . . . . 8
8. Branchlets filiform, but stiff . . . . . *Digenia*
8. Branchlets fleshy, short, spinelike . . . . . *Acanthophora*
9. Branchlets generally with contracted base; growing tip generally projecting . . . . . *Chondria*
9. Branchlets not locally contracted, the growing tip sunken *Laurencia*
10. Ultimate branchlets short, coarsely filamentous . . . 11
10. Ultimate branchlets more delicate . . . . . 12
11. Ultimate branchlets generally distichous on lateral branches . . . . . *Bryothamnion*
11. Ultimate branchlets radially placed on main branches . *Digenia*
12. Not dorsiventral, the branch tip not inrolled . . . . 13
12. Dorsiventral, at least below . . . . . 15

- 13. Branchlets ending in long monosiphonous tips . . . Lophocladia
- 13. Branchlets not ending in long monosiphonous tips . . . 14
- 14. Axis bearing spirally placed short determinate polysiphonous branchlets . . . . . Bryocladia
- 14. Axis without determinate branchlets, the secondary branches which may be present being similar to the main axes . . . Polysiphonia
- 15. Branch tips inrolled . . . . . Bostrychia
- 15. Branch tips not inrolled . . . . . Heterosiphonia

### LAURENCIA Lamouroux, 1813

Plants erect, bushy, seldom decumbent, branching, the branches moderately to quite fleshy, firm, usually cylindrical, in some species compressed, often alternately branched; apical cells protected by trichoblasts and sunken in an apical pit; tetrasporangia distributed over the short fertile branchlets at the surface; spermatangia united into paniculate clusters and immersed in the cuplike branch tips; pericarps sessile on the ultimate fertile branchlets.

#### KEY TO SPECIES

- 1. Walls of the axial cells of the main branches with refractive lenticular thickenings of the end walls; branching narrowly virgate near the tips of the main axes and side branches, the branchlets 0.20-0.45 mm. diam. . . . . *L. microcladia*
- 1. Walls of the axial cells not thickened; branchlets larger . . . 2
- 2. Plants dense and dull greenish; branchlets short, more or less tuberclelike, close set on the longer ultimate branches . . . *L. papillosa*
- 2. Branchlets not notably crowded . . . . . 3
- 3. Plants dull, blackish red, wiry, the base frequently with flagelliform branches; main erect branches sparingly divided below, where more or less naked, but above more freely alternately branched, the lateral branches virgate, with rather short, erect branchlets; fertile branchlets in small groups, shortened and crowded . . . . . *L. scoparia*
- 3. Plants not notably dark and the branches spreading . . . 4
- 4. Surface smooth, or nearly so . . . . . 5
- 4. Surface cells, particularly in the apical parts, mamilliform, or occasionally acutely projecting; plants moderately divergently branched, rather sprawling . . . . . *L. gemmifera*
- 5. Plants soft, repeatedly branched, rather pink in the branch tips, but more often green or yellow in the main axes; panic-



ulate, with well-defined main axes, the branchlets obovoid to more usually clavate-cylindrical; often large and bushy .

. . . . . L. obtusa

5. Plants stiff, less regularly and more sparingly branched, the main axes less pronounced, except near the tips, sometimes somewhat compressed; dull purplish red; branchlets mostly wartlike or peglike . . . . . L. Poitei

#### **Laurencia obtusa** (Hudson) Lamouroux

Børgesen 1915-20, p. 247, fig. 237; Taylor 1928, p. 180, pl. 33, fig. 3.

A common plant in tropical American waters, forming large masses on rocks near low-tide mark. It has been reported from Bermuda and Florida to Brazil.

PANAMA: Caledonia Harbor, common along the shore on rocks in shallow water, near Isla Piedra and I. San Augustin, *no. 39-198*, 3 April 1939. NETHERLANDS WEST INDIES: Curaçao Island, infrequent on rocks along the shore, Jan Thiel Beach, *no. 39-336*, 23 April 1939; Aruba Island, common as densely crowded, dwarf plants on coral rocks along the shore of the cove at Punta Basora, *no. 39-336*, 10 April 1939. BRITISH WEST INDIES: Tobago Island, on rocks along the shore of Buccoo Bay, *no. 39-538*, 20 April 1939.

#### **Laurencia microcladia** Kützinger

Howe 1920, p. 565; Taylor 1928, p. 179.

Apparently growing in the same situations as *L. obtusa*, and reported from Bermuda and Florida to Panama.

NETHERLANDS WEST INDIES: Curaçao Island, infrequent on rocks along the shore of Jan Thiel Beach, *no. 39-610*, 23 April 1939.

#### **Laurencia Poitei** (Lamouroux) Howe

Howe 1920, p. 566; Taylor 1928, p. 181, pl. 34, figs. 4, 10.

Not infrequent in the West Indies and adjacent waters, growing in shallow water, and reported from North Carolina and Bermuda to Brazil.

NETHERLANDS WEST INDIES: Curaçao Island, very common on broken coral rock along the shore, Jan Thiel Beach, *no. 39-608*, 23 April 1939; Aruba Island, occasional near high-tide line on rocks along the shore of the cove at Punta Basora, *no. 39-338b*, 10 April 1939. VENEZUELA: Tortuga Island, very common on rocks along the shore at Punta Arenas, *no. 39-383*, 13 April 1939.

***Laurencia gemmifera* Harvey**

Harvey 1853, p. 73, pl. 18B; Børgesen 1915-20, p. 245 (as *L. Poitei* in part, especially fig. 247); Howe 1920, p. 566.

In shallow water and dredged from moderate depths, this plant grows on broken corals and old shells, and is reported from North Carolina and Bermuda to Colombia.

PANAMA: Caledonia Harbor, on rocks along the shore in shallow water near Isla Piedra and I. San Augustin, no. 39-199b, 3 April 1939.

***Laurencia scoparia* J. Agardh ?**

De Toni 1903 (4, iii) p. 784.

Apparently known from Bermuda to Brazil, but reported only a few times; this is a plant of shallow water, growing on rocks near and above low-tide line.

VENEZUELA: Tortuga Island, rare on rocks along the shore at Punta Arenas, no. 39-382, 13 April 1939. NETHERLANDS WEST INDIES: Aruba Island, small plants on rocks of the cove at Punta Basora, no. 39-337, 10 April 1939.

***Laurencia papillosa* (Forsskål) Greville**

Børgesen 1915-20, p. 246, fig. 236; Taylor 1928, p. 180, pl. 35, fig. 4.

A very common plant, many times reported in the West Indian region, where it grows on rocks between tide marks, well exposed at low water. It ranges from Bermuda and Florida to Brazil.

PANAMA: Caledonia Harbor, very common but usually dwarf and always dense of habit and branching, on rocks along the shore in shallow water near Isla Piedra and I. San Augustin, no. 39-199, 3 April 1939. VENEZUELA: Cubagua Island, common on rocks along the beach, no. 39-461, 14 April 1939. NETHERLANDS WEST INDIES: Aruba Island, abundant near high-tide line on rocks of the cove at Punta Basora, no. 39-338a, 10 April 1939.

**CHONDRIA C. Agardh, 1817**

Plant bushy, freely alternately divided, the branches terete and the branchlets constricted sharply at the base; growth from an apical cell, the tip sometimes tapering, sometimes retracted into an apical pit, but surrounded by trichoblasts; axis with five pericentral cells and developing an ample pseudoparenchymatous cortex outside these; tetrasporangia near

the surface of little-modified ultimate branchlets; spermatangial clusters of various shapes, generally colorless plates; carpogenic branch with four cells, developed on trichoblast rudiments, which become much modified, the auxiliary being developed from the same supporting cell after fertilization.

#### KEY TO SPECIES

1. Apex truncate or depressed, the branches grading indefinitely to the straight or upcurved branchlets, which lack strong trichoblast tufts . . . . . *C. floridana*
1. Apex obtuse to acute, with definite trichoblast tufts . . . . . 2
2. Plants blackish purple, densely bushy . . . . . *C. atropurpurea*
2. Plants pale pinkish or brownish . . . . . 3
3. Main axis grading to rather similar branches, virgate; branchlets tapering from the center to the ends; tetrasporangia toward the upper end of the 2-15 mm. long ultimate branchlets; purplish on drying . . . . . *C. tenuissima*
3. Main branches sharply distinct from the more slender branches and branchlets, paniculate, commonly denuded below; branchlets 5-25 mm. long, the greatest diameter rather nearer the base; tetrasporangia generally distributed except toward the ends of the branchlets; drying to a dull yellowish brown . . . . . *C. littoralis*

#### *Chondria tenuissima* (Goodenough and Woodward) *C. Agardh*

Harvey 1853, p. 21, pl. 18F; Taylor 1937, p. 358, pl. 40, fig. 5, pl. 55, figs. 1-3.

A common species extending from the temperate waters of southern New England to the Bahamas, Florida, and Guadeloupe. It grows in shallow water on stones and broken shells, occasionally on larger algae; the plant in southern waters does not generally seem to reach the stature which prevails to the north.

VENEZUELA: Tortuga Island, scarce as washed ashore on the beach at Punta Arenas, no. 39-380, 13 April 1939.

#### *Chondria littoralis* Harvey

Harvey 1853, p. 22; Børgesen 1915-20, p. 255, figs. 248-250; Taylor 1928, p. 170.

A common tropical species, found in rather shallow and protected water on stones and broken corals. It has been reported from North Carolina and Bermuda to Guadeloupe.

COLOMBIA: A fragment dredged from 14-16 meters' depth off a bottom of coralline algae at sta. A15 near Bahia Honda, no. 39-294, 8 April 1939.

*Chondria atropurpurea* Harvey

Harvey 1853, p. 22, pl. 18E.

Rather frequent in the tropics, readily distinguished in typical specimens by its dark color and close bushy form. It seems, like the rest of the genus, to prefer shallow, protected waters. The reports indicate that it occurs from North Carolina and Bermuda to Brazil.

VENEZUELA: Tortuga Island, occasional as washed ashore on Punta Arenas, no. 39-381a, 13 April 1939.

*Chondria floridana* (Collins) Howe

Taylor 1928, p. 170, pl. 34, fig. 3.

Seldom reported, but known from Florida, Guadeloupe, and Brazil. This plant appears to affect somewhat deeper water than others of the genus.

VENEZUELA: Tortuga Island, rare, a small form washed ashore on Punta Arenas, no. 39-381b, 13 April 1939.

*ACANTHOPHORA* Lamouroux, 1813

*Acanthophora spicifera* (Vahl) Børgesen

Plant to 2 dm. tall, dull grayish purple, erect and bushy, the base of fibrous holdfast strands, the erect portion alternately branched, the firm and rather stiff cylindrical branches with five pericentral cells and a rather broad cortex; lateral spur-branches more or less abundant on the smooth main axes, short, rather crowded with alternate spinelike branchlets; tetrasporangia in short lateral branches; pericarps short urn shaped, subsessile in the axil of a spinelike branchlet; spermatangial clusters stalked, disciform.

Børgesen 1915-20, p. 259, figs. 253-258; Taylor 1928, p. 165, pl. 26, figs. 5, 6, pl. 34, fig. 7.

Very common throughout tropical American waters, ranging from Bermuda and Florida to Brazil. It is a plant of shallow water, growing near low-tide line on rocks and large broken corals.

PANAMA: Caledonia Harbor, infrequent on rocks in shallow water along the shore, near Isla Piedra and I. San Augustin, no. 39-186, 3 April 1939. NETHERLANDS WEST INDIES: Curaçao Island, common

near shore on rocks, Valentijn's Bai, Willemstad, coll. F. H. Elmore, *no. 39-570*, 23 April 1939; Aruba Island, abundant but dwarf, on rocks along the shore of the cove at Punta Basora, *no. 39-335*, 10 April 1939. VENEZUELA: Cubagua Island, infrequent on rocks along the shady beach, *no. 39-442*, 14 April 1939. BRITISH WEST INDIES: Tobago Island, rare as washed ashore on the beach, Rockly Bay, *no. 39-496*, 18-20 April 1939; common on rocks in shallow water near the shore and near the reef, Buccoo Bay, *no. 39-520*, 20 April 1939; Trinidad, dredged from 2-5 meters off a bottom of sand and algae near Port-of-Spain at sta. A35, *no. 39-486*, 18 April 1939.

### BRYOTHAMNION Kützling, 1843

Plant erect, alternately branched and bushy, firm and rather stiff, dull reddish purple; branches terete or angled, with six to eight pericentral cells and a broad cortex; minor branches of limited growth, simple or forked, bearing short to subulate branchlets along the angles of the branch, or if flattened, distichously.

#### KEY TO SPECIES

1. Axis triangular, the branches with usually 2-4 short spinelike branchlets . . . . . *B. triquetrum*
1. Axis cylindrical or flattened, the spur branches with rows of branchlets, producing either cylindrical or complanate bushy branch systems . . . . . *B. Seaforthii*

#### *Bryothamnion triquetrum* (Gmelin) Howe

Howe 1915, p. 222; Børgesen 1915-20, p. 282, figs. 282, 283; Taylor 1928, p. 169, pl. 26, fig. 10.

Forming dense bushes in shallow water on rocks and broken corals; known from the Bahamas and Florida to Brazil.

PANAMA: Caledonia Harbor, frequent on rocks in shallow water along shore, near Isla Piedra and I. San Augustin, *nos. 39-190*, 3 April 1939, and *39-238*, 4 April 1939. VENEZUELA: Tortuga Island, frequent tufts on rocks along the shore, Punta Arenas, *no. 39-370*, 13 April 1939.

#### *Bryothamnion Seaforthii* (Turner) Kützling, forma *disticha* J. Agardh

Børgesen 1915-20, p. 284, figs. 284-286; Taylor 1928, p. 168, pl. 26, figs. 8, 9.



Perhaps less common than *B. triquetrum*, and apparently restricted to moderately deep water, having generally been found washed ashore, but known to have been dredged from a depth of 30 meters. Reported from the Bahamas and Florida to Brazil.

BRITISH WEST INDIES: Tobago Island, a few pieces drifted on the beach, Buccoo Bay, no. 39-528, 20 April 1939.

### CLADHYMENIA Hooker and Harvey, 1845

Plants forming flat blades which branch from the margin, frequently in subflagellar manner, the blades with an obscure costa within which the nominally five pericentral cells are generally obscured by growth of slender filaments between them; tetrasporangia in slender marginal pinnules; cystocarps lateral on marginal pinnules, with subovate pericarps.

#### *Cladhymania* (?) *lanceifolia* n. sp.<sup>12</sup>

Plate 3, Figs. 1-5; Plate 19, Figs. 1-4

Plant to 10 cm. high (perhaps more) from a sparingly branched coarsely fibrous holdfast, which gives rise to one to several erect axes; primary axes cylindrical and firm below, forming a stalk to 2-5 mm. long, or this obsolescent, above gradually expanded to a lanceolate blade which may reach 8 mm. in width, 5-7 cm. in length, the margin vaguely undulate, the midrib rarely distinguishable, the texture membranous, the color (when dried) dark brownish red; branching from the lower part of the axis flagelliform, the flagellar extensions able to attach by padlike expansions of the tip and thereby reinforce the holdfast, but above on the blade the branches marginal or submarginal, irregularly disposed, linear and subcylindrical to linear-lanceolate, or ultimately similar to the primary blades.

COLOMBIA: Bahia Honda, numerous specimens dredged from 14-16 meters' depth off a bottom of coralline algae at sta. A15, no. 39-240, 8 April 1939.

These specimens so much resemble such Delesseriaceae as *Hymenena* that the writer expected to find them merely ill-developed representatives of that group, until microscopic examinations showed fugacious sparingly

<sup>12</sup> *Cladhymania lanceifolia*—Planta ex haptero sparse ramoso usque ad 10 cm. altitudine oriens, axem erectum unum aut plures habens, infra cylindrica 2-5 mm., supra in laminam lanceolatam membranaceamque usque ad 8 mm. latitudine expansa, costa media raro visibili; ramis infra flagelliformibus, supra, autem, marginalibus aut submarginalibus, irregulariter dispositis, et a cylindricis ad complanatos atque lineari-lanceolatos variantibus, aut cum laminis primariis intergradientibus. Planta typica in loco dicto Bahia Honda, Colombia, no. 39-240, 8 April 1939.

branched trichoblasts near the growing point. The apical cell is prominent and divides transversely. From dried material little could be learned of later divisions in the axis, for cortication proceeds rapidly. Apparently there are five pericentral cells, but their orientation in the blades is confused, and their ends in succession overlap. The axial siphon is clear in sections. The medulla of the blade is 2-4 cells thick; the cells are large. Outside there are 1-2 layers of smaller cells, of which one is the chromatophore-rich cortex. Viewed from the surface this outer layer shows only a confused arrangement near the growing point; then comes a zone of roughly transverse rows, but in the oldest parts the cells are again irregularly arranged and slightly sinuose in form.

The primary blades in the specimens secured were commonly damaged near the end, and were regenerating by numerous flagellar to subfoliar outgrowths. No reproductive stages were secured; consequently, the generic assignment of these plants must be considered tentative.

### DIGENIA C. Agardh, 1822

#### *Digenia simplex* (Wulfen) C. Agardh

Plant to 25 cm. tall, irregularly but sparingly dichotomously branched, the axis and main branches heavily corticated about the six to eight pericentral cells, densely clothed above with slender, stiff squarrose polysiphonous branchlets 5-10 mm. long which may be corticated near the base; tetrasporangia borne in the upper portion of nodulose branchlets; spermatangial clusters near the summits of branchlets; pericarps near the middle or in the upper portion of the branchlets.

Taylor 1928, p. 175, pl. 24, fig. 20, pl. 33, fig. 7.

A common tropical alga in many parts of the world, found in clumps on rocks in shallow water and frequently in the intertidal zone. This plant has been reported from Bermuda and Florida to Brazil.

PANAMA: Caledonia Harbor, locally abundant, forming large tufts on rocks in shallow water near Isla Piedra and I. San Augustin, *nos.* 39-205, 3 April 1939, and 39-237, 4 April 1939.

### BRYOCLADIA Schmitz, 1897

Plant with a creeping, matted base bearing erect filaments which are alternately branched, ecorticate, with six to sixteen pericentral cells; determinate lateral branchlets spirally placed, short and stiff, ultimately commonly recurved; tetrasporangia single in the segments, inserted along

the outer side of the branchlets; cystocarps urn shaped, stalked, among the lateral branchlets.

### KEY TO SPECIES

1. Main branches bearing simple branchlets; pericentral cells 8  
     . . . . . *B. cuspidata*
1. Main branches bearing alternately divided branchlets; pericentral cells 10 . . . . . *B. thyrsgera*

#### ***Bryocladia cuspidata* (J. Agardh) De Toni**

Taylor 1928, p. 168.

This plant is found in the intertidal zone, on rocks within reach of the waves, associated with *Enteromorpha*s and the like. It has been reported from Florida to Trinidad Island, but not on many occasions.

VENEZUELA: Cubagua Island, frequent on rocks along the beach, no. 39-452, 14 April 1939.

#### ***Bryocladia thyrsgera* (J. Agardh) Schmitz**

Taylor 1928, p. 168.

This plant is found in the same kind of situations as *B. cuspidata*, and ranges from Florida to Brazil.

VENEZUELA: Tortuga Island, common on rocks along the shore at Punta Arenas, no. 39-407, 13 April 1939; Cubagua Island, infrequent on rocks along the shore, no. 39-453, 14 April 1939.

### **POLYSIPHONIA Greville, 1824**

#### ***Polysiphonia Binneyi* Harvey**

Plants tufted, to 2-4 cm. tall, yellowish to purplish, and rather stiff; the branching alternate, at wide angles, the primary branches arising in the angles of trichoblasts; pericentral cells four, cortication absent; filaments to 200-350  $\mu$  diam. below, 150  $\mu$  in the branchlets, the segments shorter than broad, to subequal.

Harvey 1853, p. 37; Taylor 1928, p. 183.

Plants of shoals or of water of moderate depth, infrequently reported from Florida and the Bahamas to Guadeloupe.

VENEZUELA: Tortuga Island, infrequent with algae on rocks along the shore at Punta Arenas, no. 39-418, 13 April 1939. NETHERLANDS WEST INDIES: Aruba Island, infrequent, forming bright yellow tufts on rocks exposed at midtide, cove at Punta Basora, no. 39-311, 10 April 1939.

**LOPHOCLADIA** Schmitz, 1893**Lophocladia trichoclados** (Mertens) Schmitz

Plate 20, Figs. 1, 2

Plants bushy, rosy, very soft, decumbent and attached by haptera below, above widely dichotomously branched, the axis with four pericentral cells, naked above but corticated by rhizoids below; branches above penicillate, covered with monosiphonous dichotomous branchlets about 2 mm. long, which fork at acute angles; stichidia acuminate, flexuose, with 6-8 prominent tetrasporangia; spermatangial clusters replacing lower branchlets of the lateral tufts; pericarps near the base of a branchlet.

Harvey 1853, p. 65 (as *Dasya lophoclados*); Børgesen 1915-20, p. 302, figs. 304-312; Taylor 1928, p. 181.

Occasionally reported from tropical American waters; known from Bermuda and Florida to Barbados. It appears to be a plant of moderately deep water.

VENEZUELA: Tortuga Island, abundantly washed ashore on Punta Arenas, no. 39-384, 13 April 1939.

**BOSTRYCHIA** Montagne, 1838<sup>13</sup>**Bostrychia Binderi** Harvey

Plants with a more or less decumbent thallus, composed of primary spreading filaments attached by hapteral branches, at the forward end more erect and bearing alternate erect lateral branches; these branches with drooping determinate lateral spur branches which are short and pinnately divided; main axes with 1-3 series of large cells between the axis and the outer cortex; branchlets 12-40 segments long, without monosiphonous tips, or these when present of few cells; tetrasporangia in swollen stichidia formed by the terminal portion of the spur branches.

Howe 1920, p. 573; Taylor 1928, p. 166 (both as *Amphibia pectinata*); Post 1936, p. 28.

PANAMA: Caledonia Harbor, infrequent on rocks along the shore near Isla Piedra and I. San Augustin, no. 39-194, 3 April 1939; common on mangrove roots, with *Catenella*, around a lagoon behind the marginal forest, southeast end of the harbor, no. 39-618b, 27 April 1939.

<sup>13</sup> Briquet 1935. *Bostrychia* Montagne, 1838, is conserved over *Amphibia* Stackhouse, 1809.

## HETEROSIPHONIA Montagne, 1842

Plant erect or decumbent, the dichotomous to irregularly divided main axes bearing alternate pinnate or bipinnate sometimes subdichotomous lateral branches which are polysiphonous toward the base, uniseriate toward the tips; pericentral cells generally four or six, sometimes when dorsiventral those on the lower side dividing; cortex present or absent, rhizoidal in character; tetrasporangia in well-developed stichidia replacing a division of the branchlets; spermatangial clusters similarly placed, pointed; pericarp developed near the base of a branchlet.

### KEY TO SPECIES

1. Plant small, 1-2 cm. long, creeping among other algae; the main axis dichotomously divided and uncorticated, somewhat dorsiventral, the uniseriate branchlets subdichotomously 2-4 times branched, 100  $\mu$  diam. at the base, about 50  $\mu$  above . . . . . H. Wurdemanni
1. Plant to 1-2 dm. tall, the main axes little branched except at the base, the erect axes denudate below, bearing alternate pinnate or bipinnate branchlets; branchlets polysiphonous near the base, uniseriate and dichotomous at the tips . . . H. Gibbesii

### *Heterosiphonia Wurdemanni* (Bailey) Falkenberg

Harvey 1853, p. 64, pl. 15C (as *Dasya Wurdemanni*); Børgesen 1915-20, p. 324, fig. 326; Taylor 1928, p. 178, pl. 25, fig. 3.

This obscure creeping plant is seldom found in any quantity, but not infrequently is a small element in a mixed association. It has been reported from Bermuda and Florida to Barbados.

COLOMBIA: Rare on *Sargassum* dredged from 16-18 meters off a bottom of coralline algae at sta. A15 near Bahia Honda, no. 39-280, 8 April 1939. VENEZUELA: Tortuga Island, infrequent on larger algae washed ashore on Punta Arenas, no. 39-394, 13 April 1939.

### *Heterosiphonia Gibbesii* (Harvey) Falkenberg

Harvey 1853, p. 59, pl. 15A (as *Dasya Gibbesii*); Taylor 1928, p. 178, pl. 25, fig. 2, pl. 35, figs. 1, 2.

An infrequently reported, but quite handsome plant of the American tropics; it has been reported from Florida, the Bahamas, and Jamaica, and grows in shallow water on broken corals, stones, etc.



VENEZUELA: Tortuga Island, rare as washed ashore on Punta Arenas, no. 39-395, 13 April 1939.

**AMANSIA** Lamouroux, 1809

***Amansia multifida*** Lamouroux

Plant upright and bushy, to 10 cm. tall, light red and translucent, freely alternately pinnately branched, the branches membranous, to 2-5 mm. wide, with a midrib which shows five pericentral cells and a cortex, bordered by a wide two-layered membrane; principal axes and, to a lesser degree, minor branches, with recurved rolled apex; tetrasporangia in linear stichidiumlike branchlets.

Taylor 1928, p. 165, pl. 29, fig. 5.

Probably a plant of moderately deep water, and growing on rocks or broken corals; ordinarily found as washed ashore. Reported from the Bahamas and Florida to Brazil, and not uncommon. One of the more beautiful and structurally interesting of the West Indian marine Rhodophyceae.

VENEZUELA: Tortuga Island, scarce as washed ashore on the beach at Punta Arenas, no. 39-393a, 13 April 1939. BRITISH WEST INDIES: Tobago Island, a few fragments washed ashore in Rockly Bay, no. 39-491, 18-20 April 1939; one piece washed ashore, Buccoo Bay, no. 39-533, 20 April 1939.

**VIDALIA** Lamouroux, 1824

***Vidalia obtusiloba*** (Mertens) J. Agardh

Plant erect, moderately pinnately branched and bushy, to 15 cm. tall, dull reddish in color, firmly membranous in texture; branches ligulate-flattened, 4-7 mm. wide, with a costa somewhat obscure, except below, showing five pericentral cells and a cortex, laterally expanding to a firm membrane of two layers; branch apices plane or sometimes slightly in-rolled; margins pinnately serrate, the tetrasporangial stichidia developing from such teeth; pericarps sessile, subglobose, single on marginal teeth.

Taylor 1928, p. 186, pl. 29, fig. 4.

Known by a few records from Florida to Brazil, this is probably a plant of moderately deep water, and chiefly collected as washed ashore.

VENEZUELA: Tortuga Island, scarce as washed ashore on the beach at Punta Arenas, no. 39-393b, 13 April 1939.

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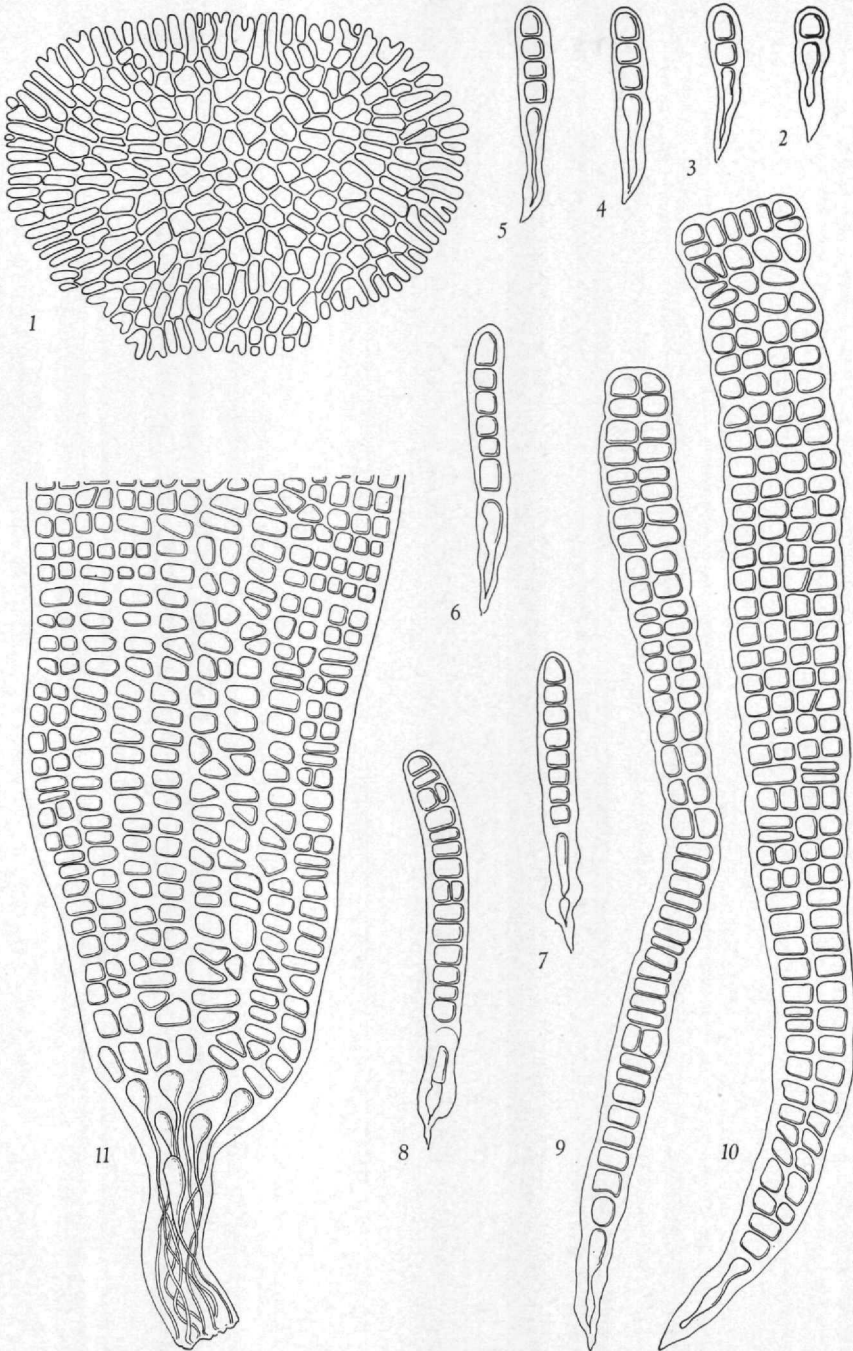
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## PLATE 1

Fig. 1. *Erythrocladia subintegra*. Surface of disk. Tobago Island. x 560.

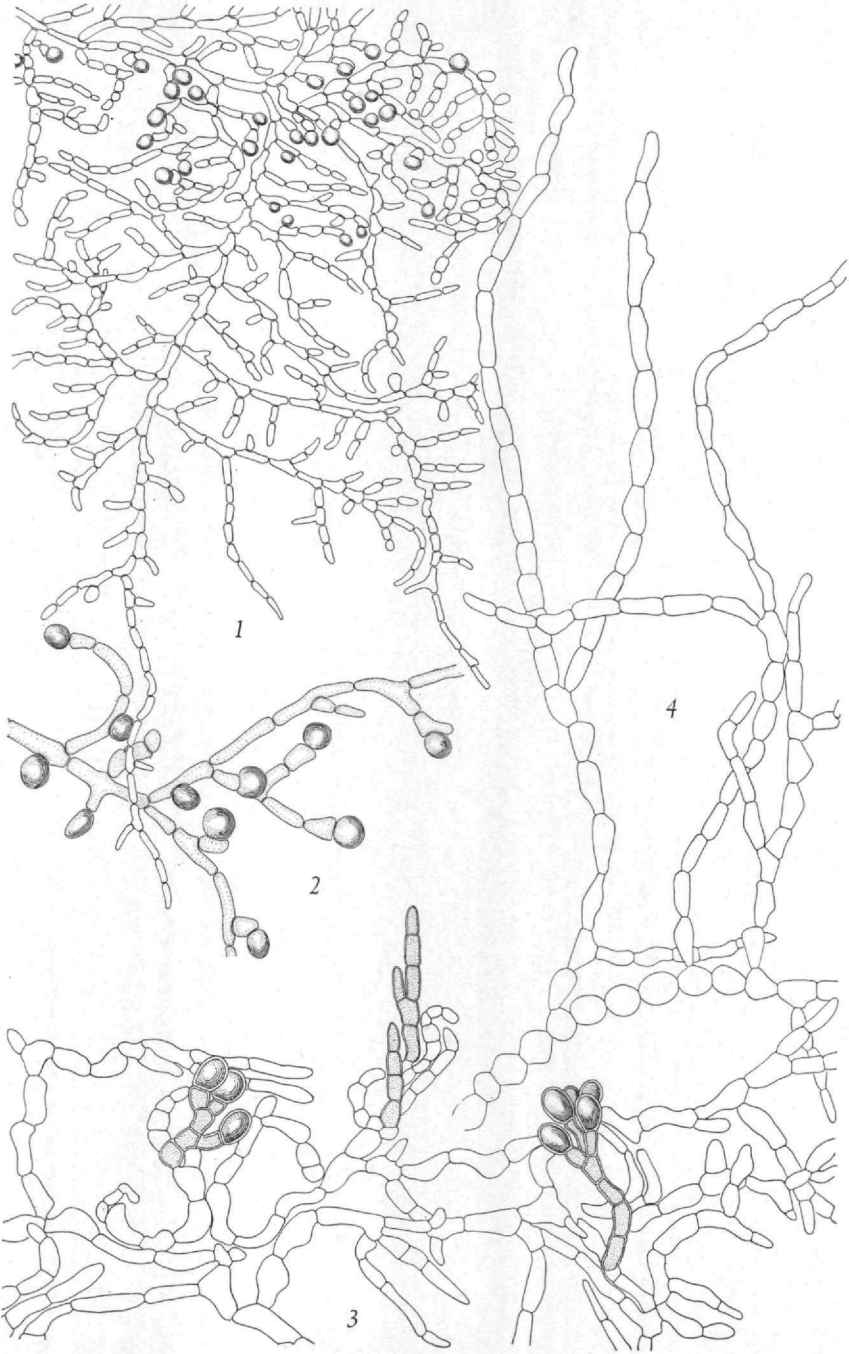
Figs. 2-11. *Erythrotrichia vexillaris*. Figs. 1-10, developmental stages from 2-celled germling to the 4-seriate band, showing the manner of growth of the plant. Fig. 11, basal portion of a fully developed specimen showing the formation, from the lower cells, of rhizoidal extensions which pass down through the wall membranes to fortify the original holdfast cell. Venezuela. x 340.



## PLATE 2

Figs. 1, 2. *Erythrocladia pinnata*. Fig. 1, portion of a mature colony, showing ramification of the filaments and the production of monosporangia in the older, denser portion. x 410. Fig. 2, small portions of the fruiting branches, showing various positions of the monosporangia. x 780. Tobago Island.

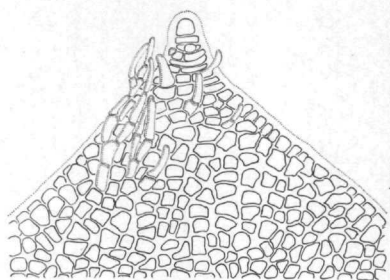
Figs. 3, 4. *Acrochaetium antillarum*. Fig. 3, portion of fruiting specimen showing two erect sterile branches and two erect sporangium-bearing ones, the cells stippled. x 410. Fig. 4, portion of a young, sterile branch system showing contrasting cell forms. x 410. Tobago Island.



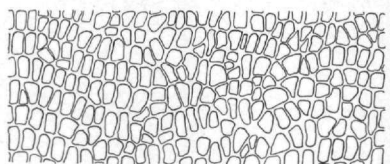


## PLATE 3

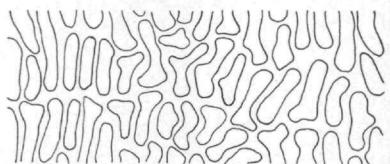
- Figs. 1-5. *Cladhymenia lanceifolia*. Figs. 1-3, successive surface areas from the stem apex to a nearly mature portion, showing the apical cell and trichoblasts and the ultimately sinuous cell form. x 250, 250, 60. Fig. 4, transverse section in a thin region, not axial. x 85. Fig. 5, transverse section through the axial row in an old blade, showing the axis and the irregularly displaced pericentral cells. x 85.
- Fig. 6. *Halymenia Hancockii*. Transverse section of the blade, showing cell form and arrangement. x 385.
- Figs. 7, 8. *Leptofaukea rhodymenioides*. Fig. 7, transverse section of the blade, showing structure. x 170. Fig. 8, portion of a sorus showing the paraphyses with sporangia in various stages of development. x 270.
- Fig. 9. *Faukea peltata*. Transverse section of the blade, showing structure. x 170.
- Fig. 10. *Gracilaria venezuelensis*. Transverse section of the blade, showing structure. x 65.



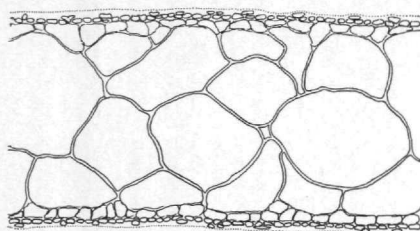
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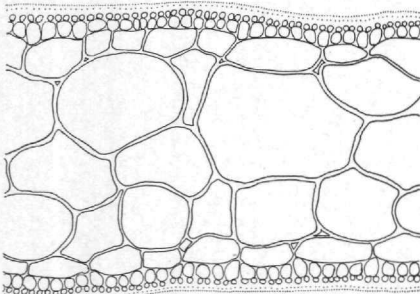
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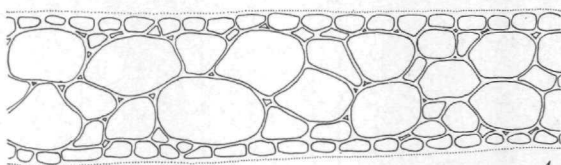
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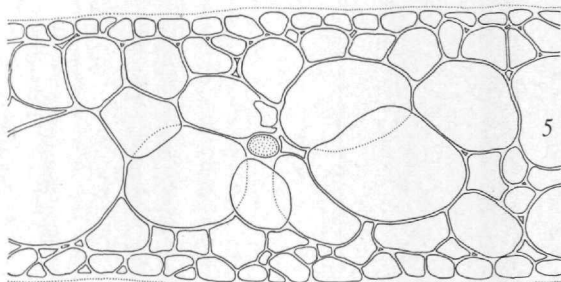
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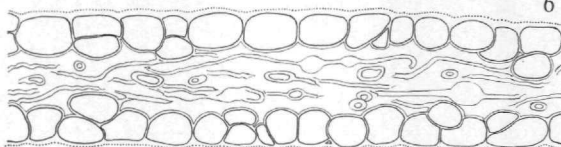
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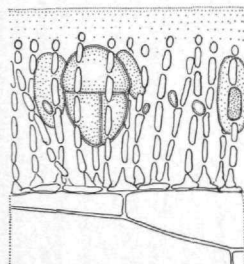
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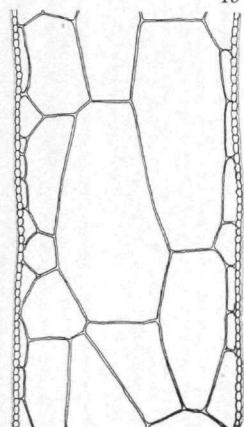
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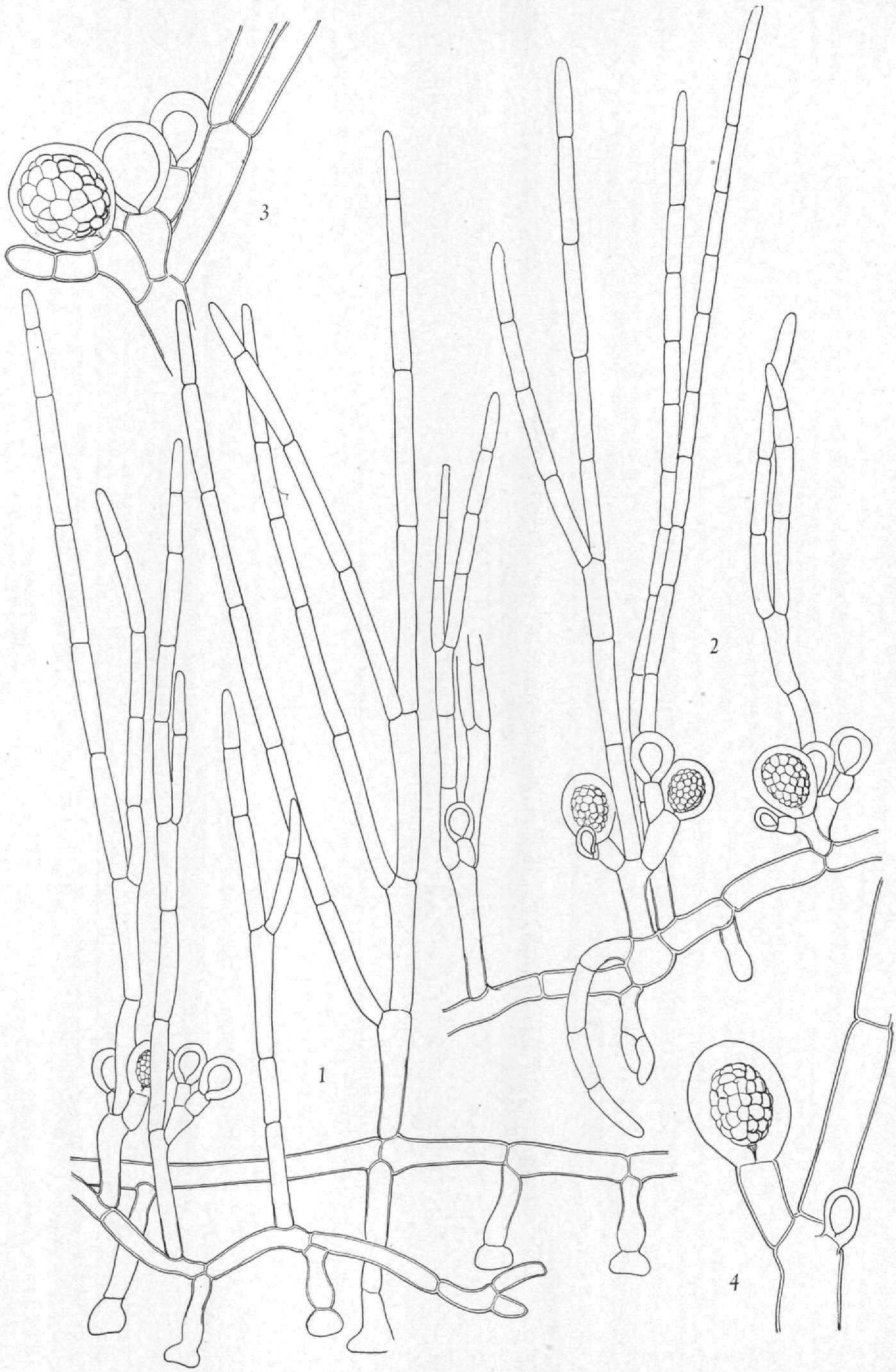
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## PLATE 4

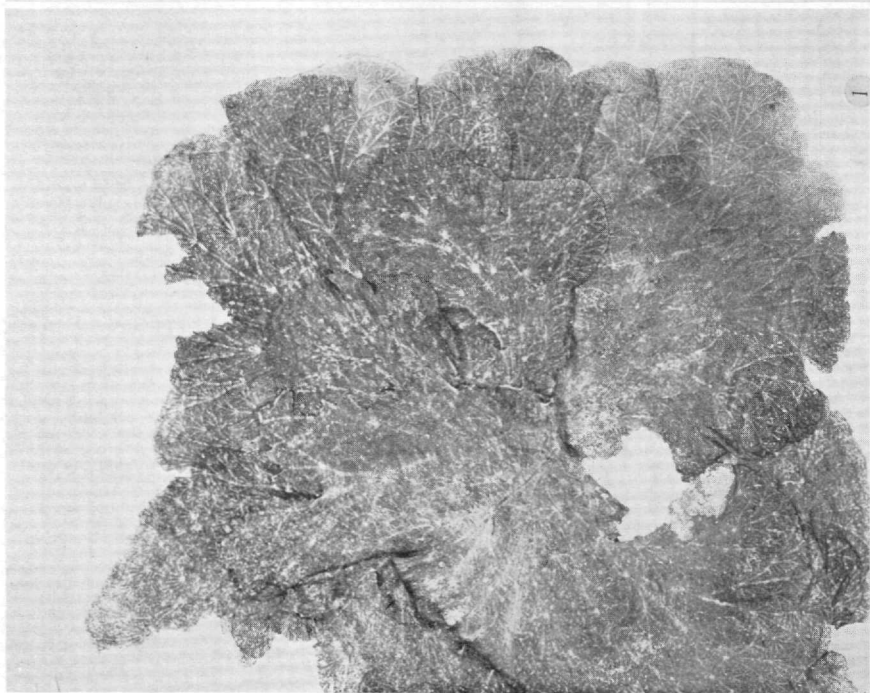
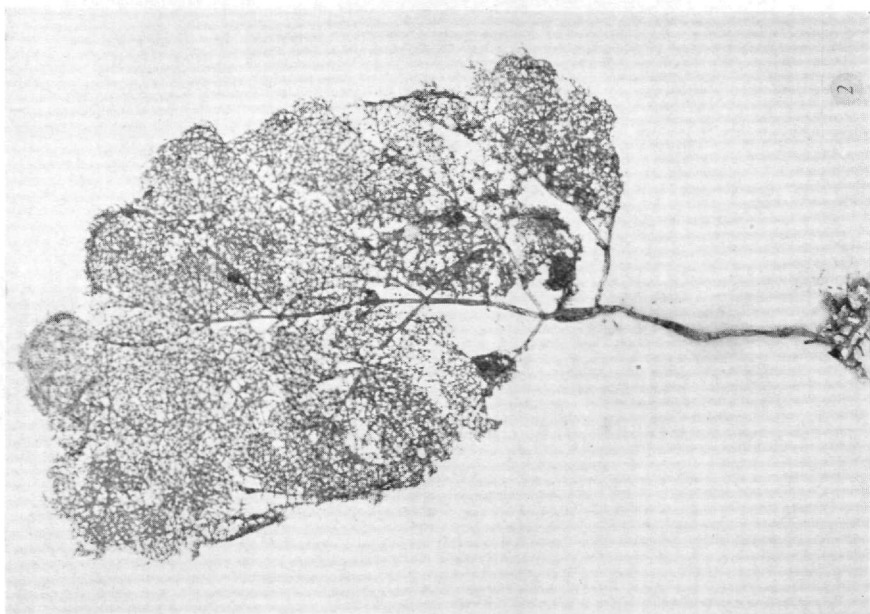
Figs. 1-4. *Spermothamnion gorgoneum*. Figs. 1, 2, general views of portions of plants showing variations in the type of hold-fast cell and stages in sporangium development. x 65. Figs. 3, 4. Sporangia, more enlarged. x 125, 210. Gorgona Island.



## PLATE 5

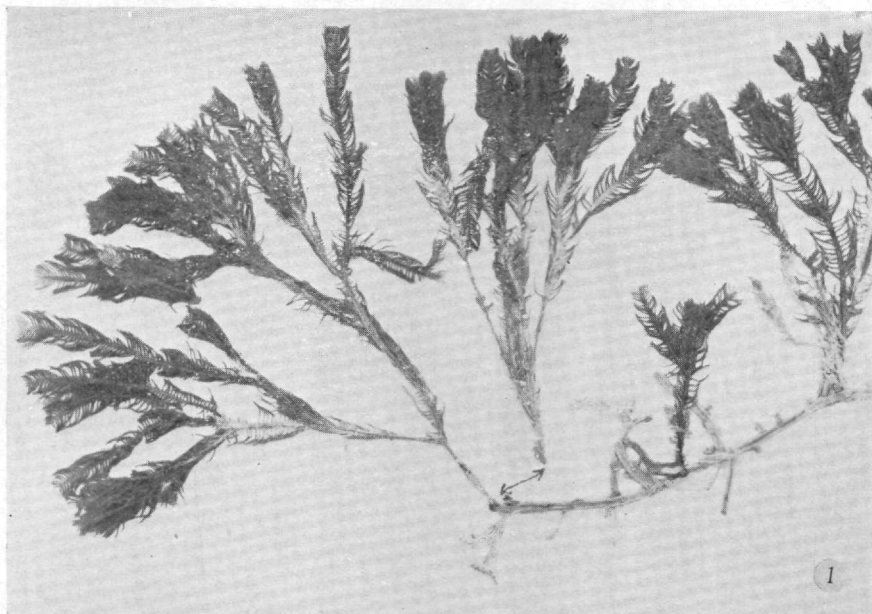
- Fig. 1. *Anadyomene stellata*. Photograph of a pressed specimen showing the arrangement of the main cells in fan-shaped groups. Panama. x 3.4.
- Fig. 2. *Struvea ramosa*. A single large blade, with the lower segments somewhat separate at the base. Aruba Island. x 1.1.





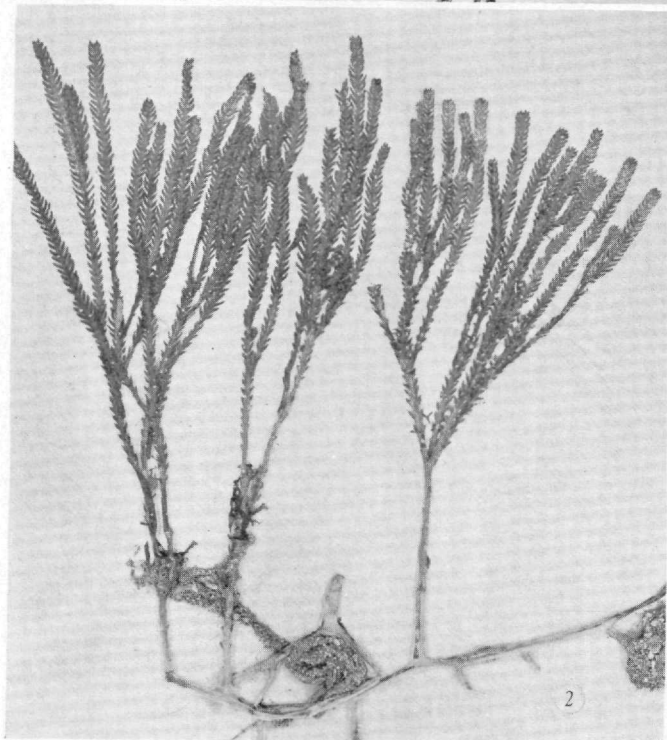
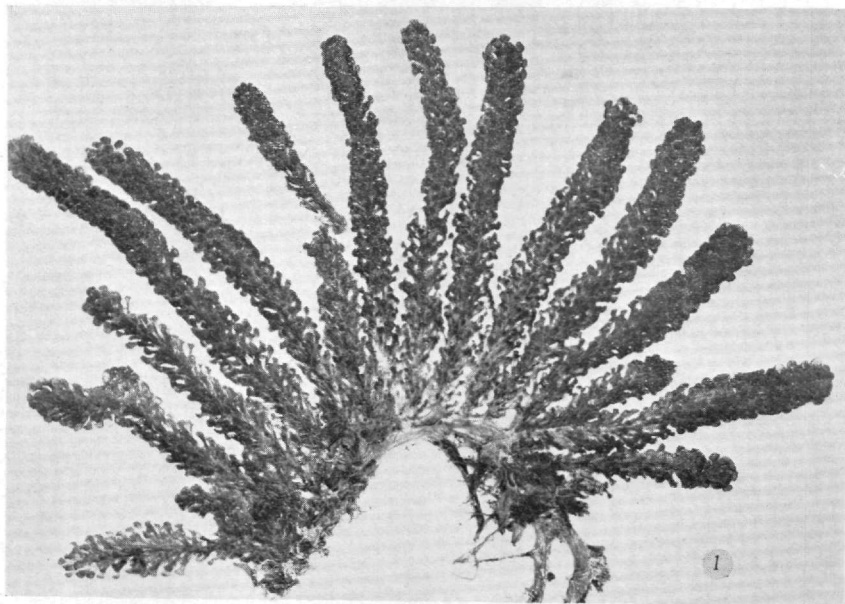
## PLATE 6

- Fig. 1. *Caulerpa sertularioides* f. *corymbosa*. Showing the erect branched axes of a well-developed specimen. Curaçao Island. x 0.8.
- Fig. 2. *Caulerpa sertularioides* f. *Farlowii*. Showing the crowded, multiseriate branchlets of the short, erect axes. Aruba Island. x 1.6.



## PLATE 7

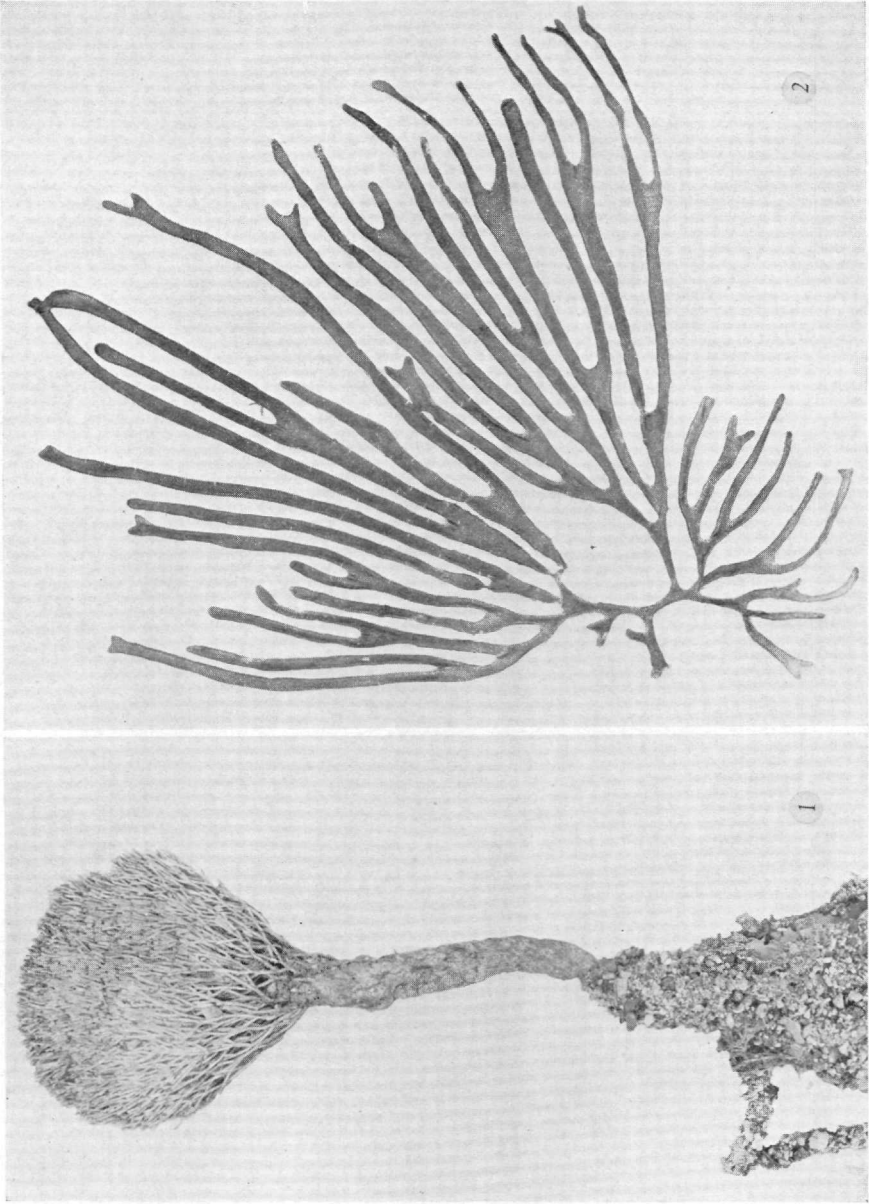
- Fig. 1. *Caulerpa racemosa* var. *laetevirens*. Showing a very well-developed specimen from a quiet tide pool. Panama. x 0.75.
- Fig. 2. *Caulerpa cupressoides* var. *Lycopodium*. A specimen showing the unusually long, biseriate branchlets of the variety. Tobago Island. x 0.75.





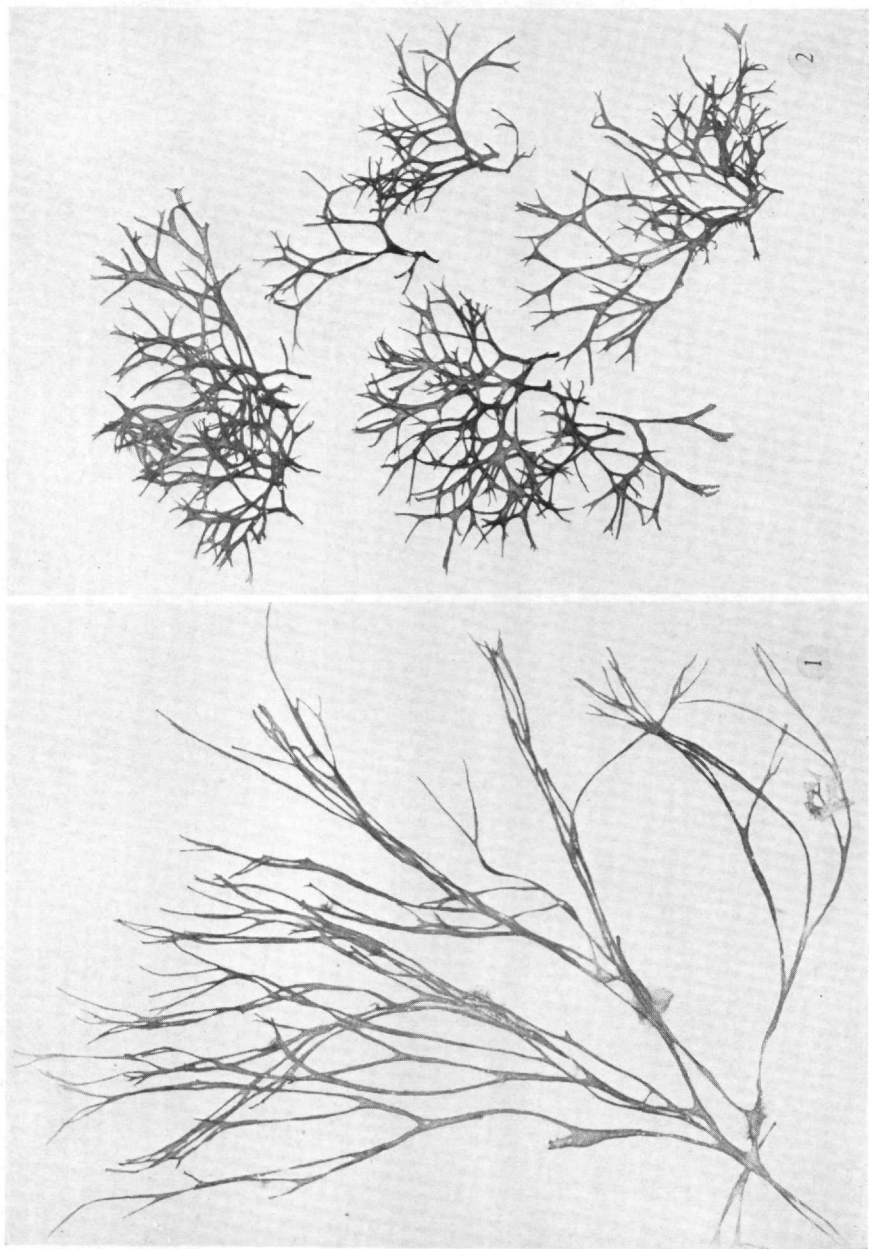
## PLATE 8

- Fig. 1. *Penicillus Lamourouxii*. A single large specimen showing the stout capitular filaments and the short, thick stipe typical of the species. Panama. x 1.15.
- Fig. 2. *Codium decortcatum*. Portion of a specimen to show the branching and the flattening below the forks. Tobago Island. x 0.35.



## PLATE 9

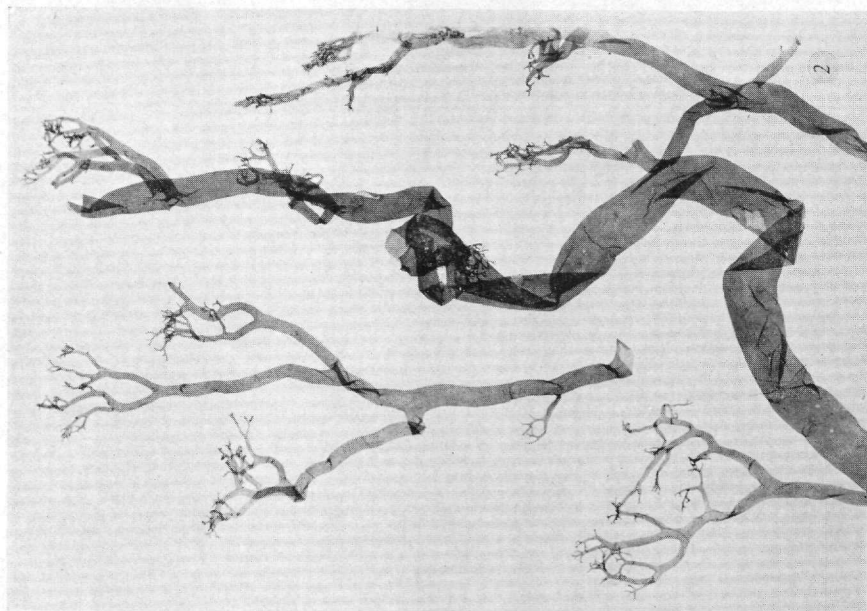
Figs. 1, 2. *Chnoospora pacifica*. Fig. 1, tall, lax specimens from a sheltered cove. Aruba Island. x 0.75. Fig. 2, stiff, small and tufted specimens from a more exposed situation. Curaçao Island. x 1.1.



## PLATE 10

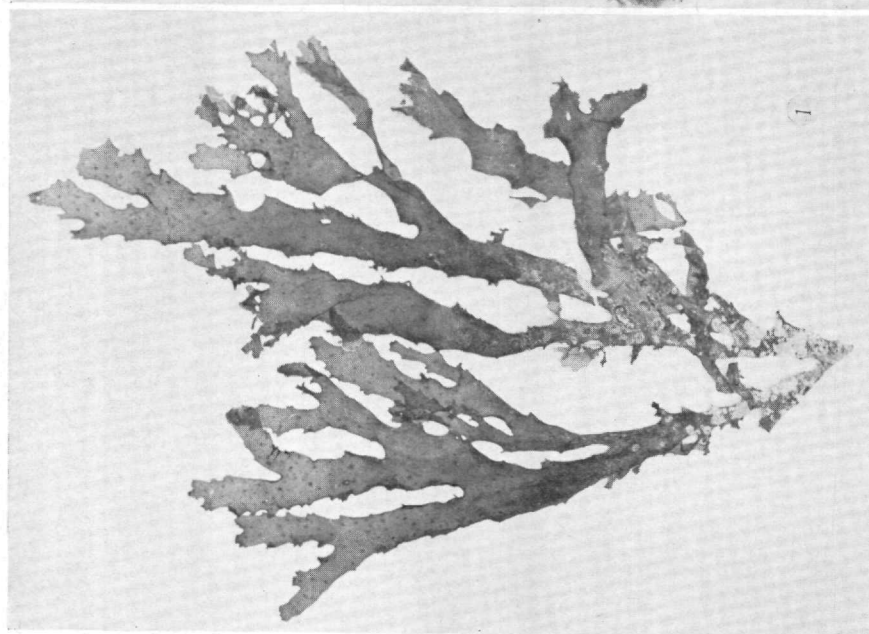
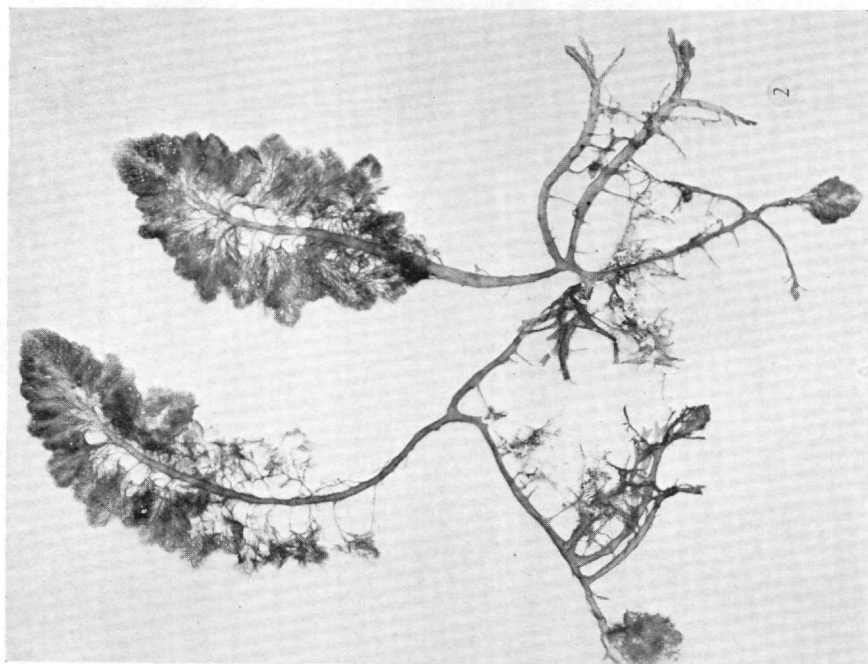
- Fig. 1. *Rosenvingea sanctae-crucis*. A group of well-grown specimens which were much involved at the base. Venezuela. x 0.85.
- Fig. 2. *Rosenvingea intricata*. Exceptionally tall and well-developed specimens. Venezuela. x 0.7.





## PLATE 11

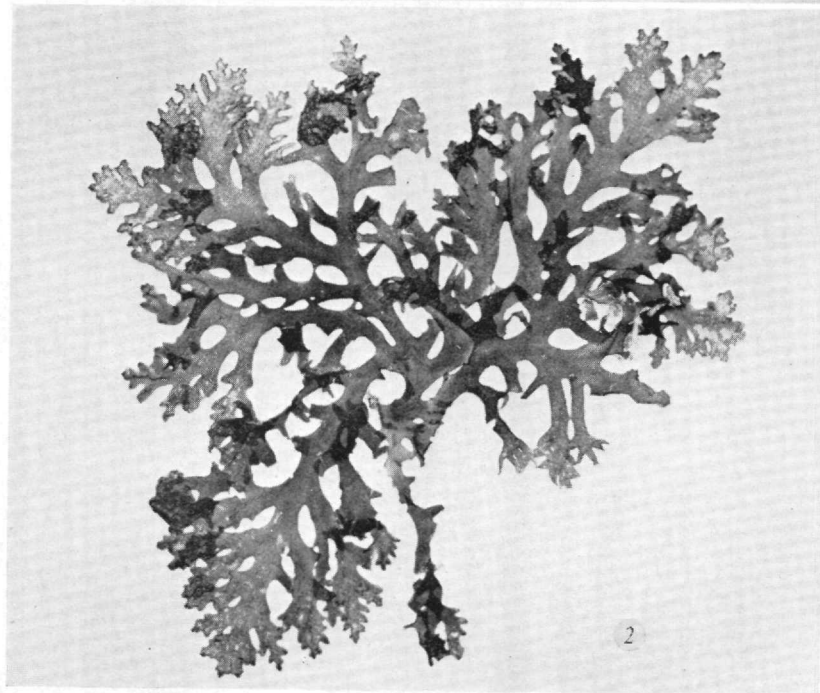
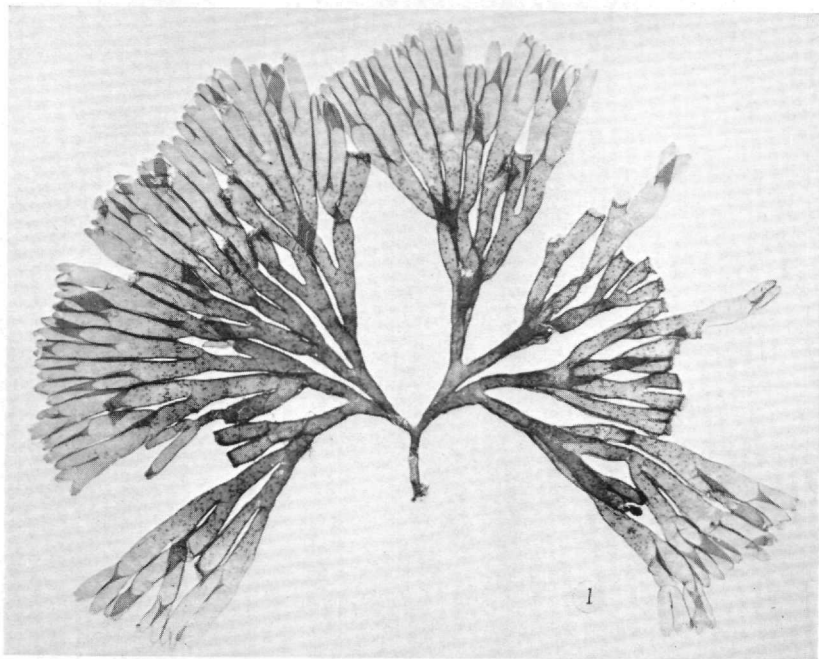
- Fig. 1. *Spatoglossum Schroederi*. Portion of an old plant showing branching. Tobago Island. x 0.6.
- Fig. 2. *Asparagopsis taxiformis*. Plant showing the rhizomatous and the erect branches. Venezuela. x 1.1.



## PLATE 12

Fig. 1. *Scinaia complanata*, f. A cystocarpic plant showing habit and the shape of the branches. Tobago Island. x 1.1.

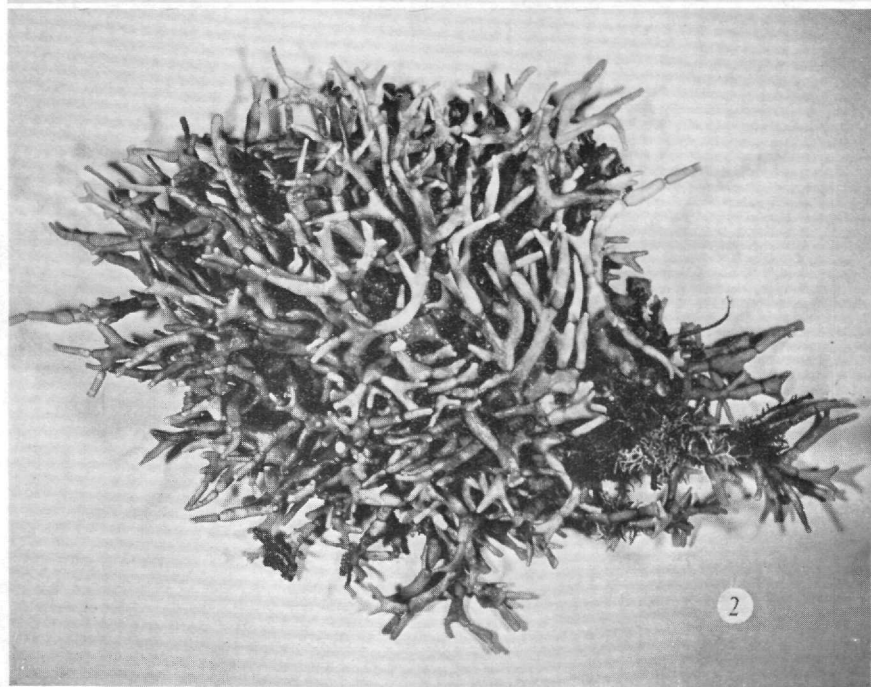
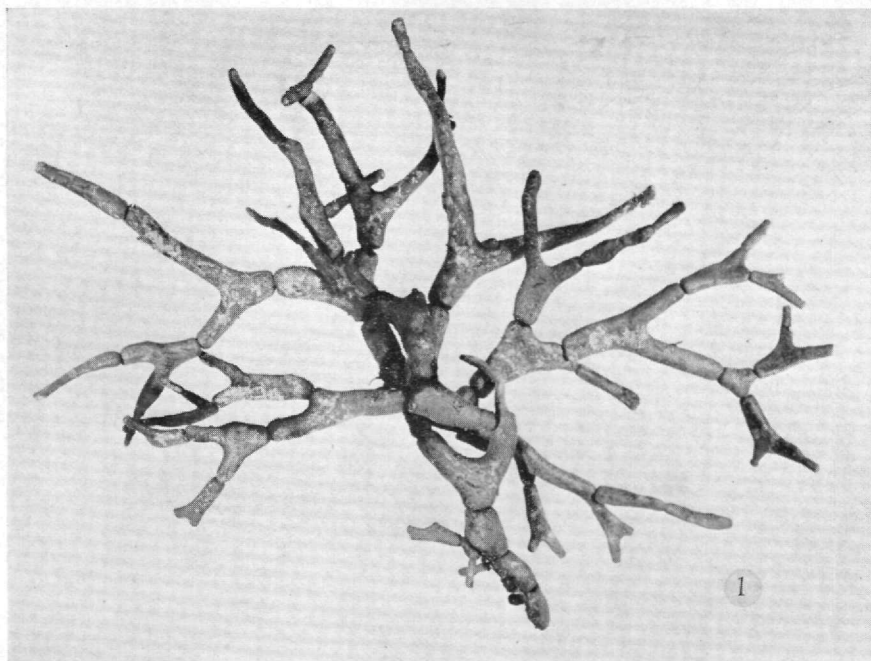
Fig. 2. *Platoma cyclocolpa*. Portion of a plant showing the extensive alternate branching. Aruba Island. x 1.75.





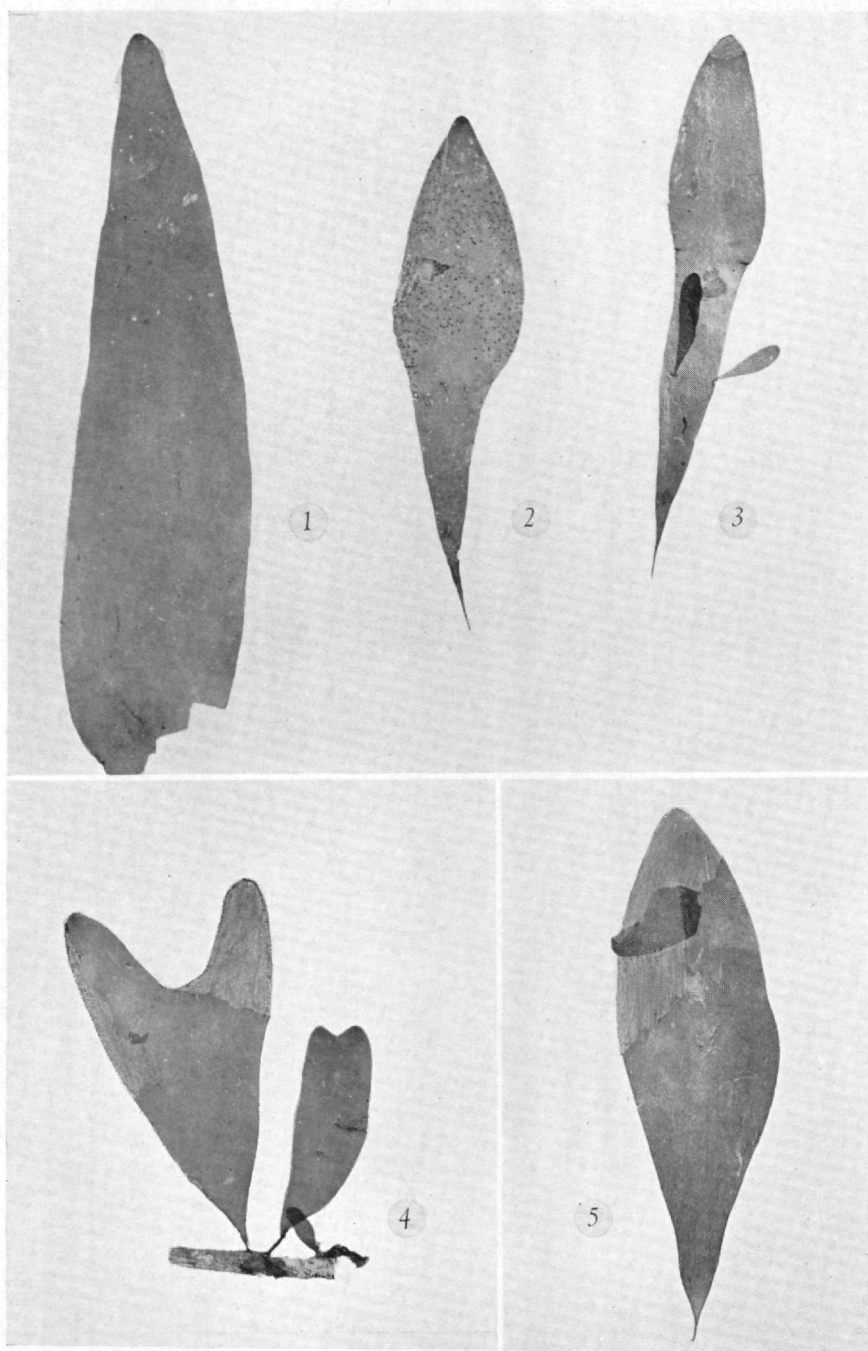
## PLATE 13

Figs. 1, 2. *Amphiroa Hancockii*. Fig. 1, small portion to show the form of the segments and branching. None of the older, larger, and flatter fruiting segments appear. x 1.0 approx. Fig. 2, a plant showing the general growth aspect in the living state. x 0.6 approx. Panama. Photographs furnished by the kindness of the Hancock Foundation.



## PLATE 14

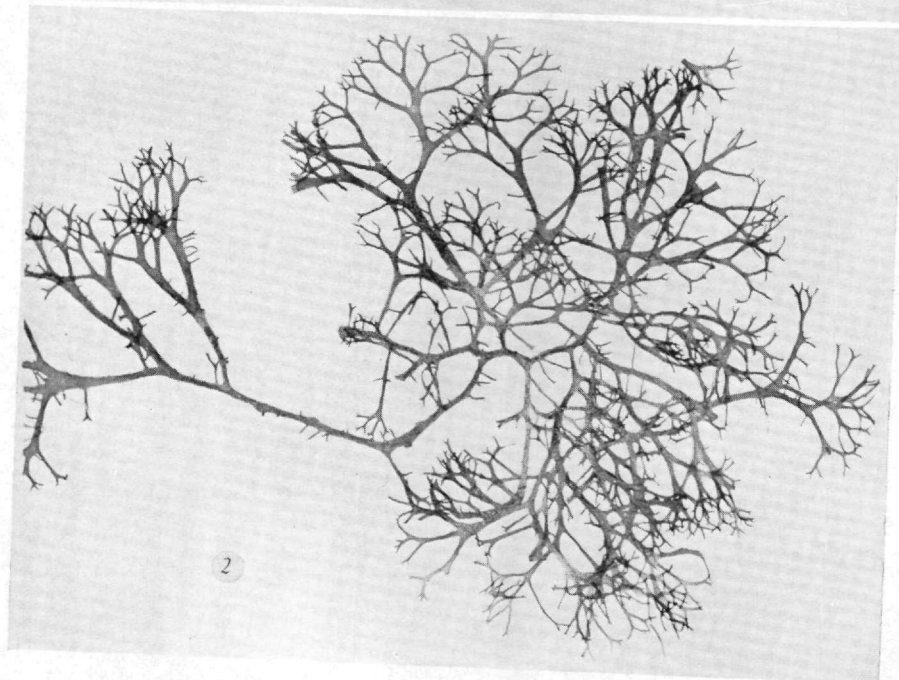
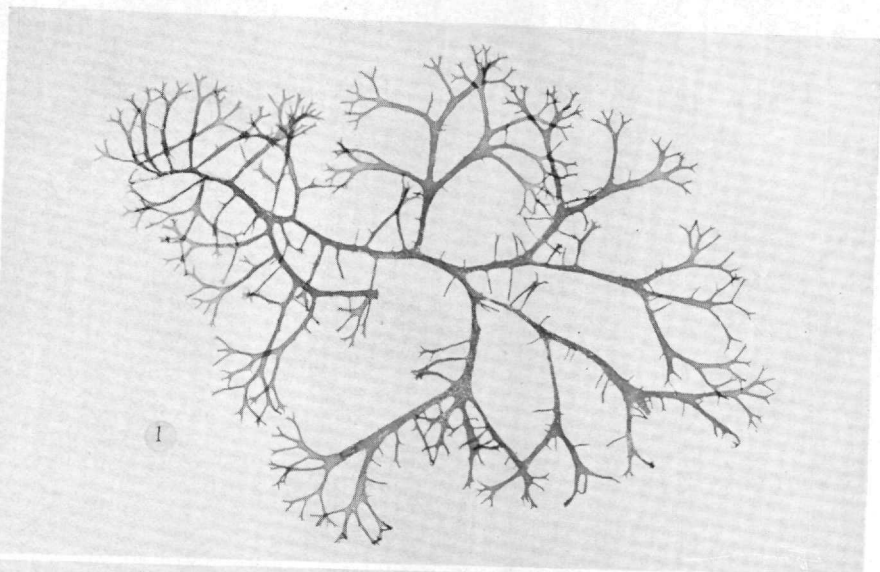
Figs. 1-5. *Halymenia Hancockii*. Fig. 1, upper portion of a large tetrasporangial plant. Fig. 2, complete specimen of a mature cystocarpic plant. Fig. 3, complete plant showing proliferations. Fig. 4, two specimens on a fragment of gorgonian, showing forking at the tip (partly reconstructed). Fig. 5, a large specimen, the tip reconstructed. Colombia. x 1.25.



## PLATE 15

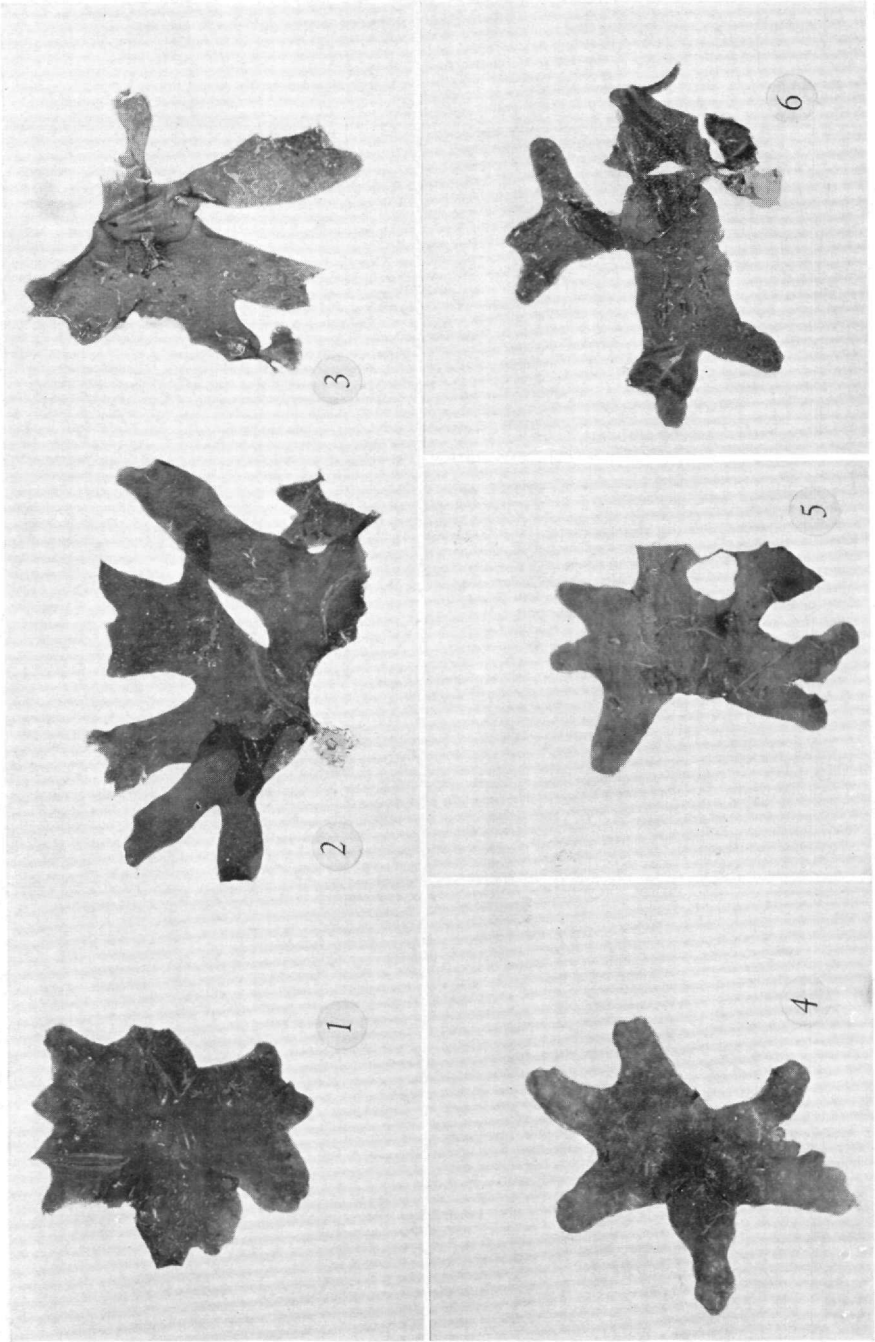
Figs. 1, 2. *Gracilaria venezuelensis*. Two portions of clumps, showing the primary branching and the lateral spurs. Venezuela. x 0.6.





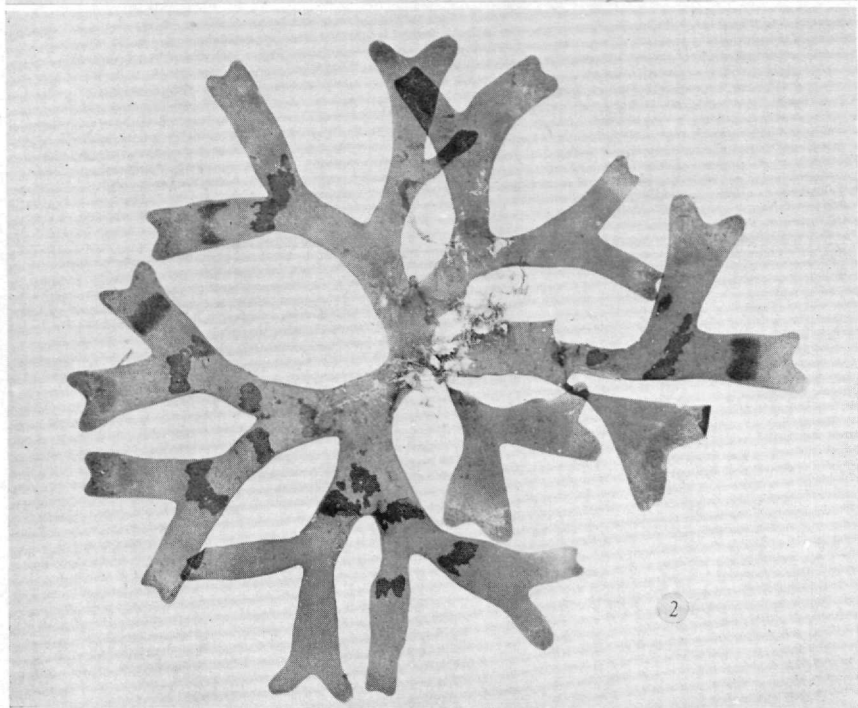
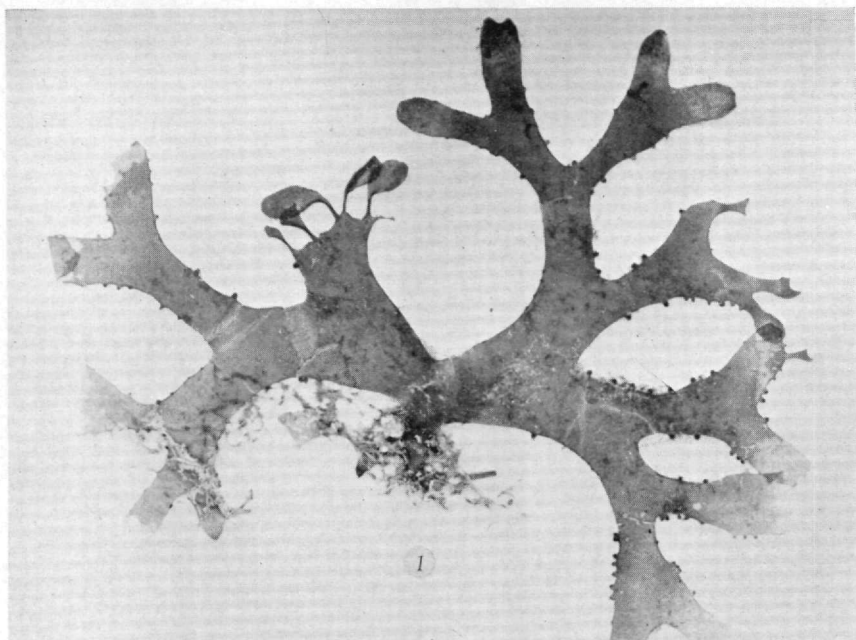
## PLATE 16

Figs. 1-5. *Faucheia peltata*. Figs. 1, 3, 4, 5 represent peltate specimens. Figs. 2 and 6, specimens in which the stalk is marginal. Venezuela. x 1.4.



## PLATE 17

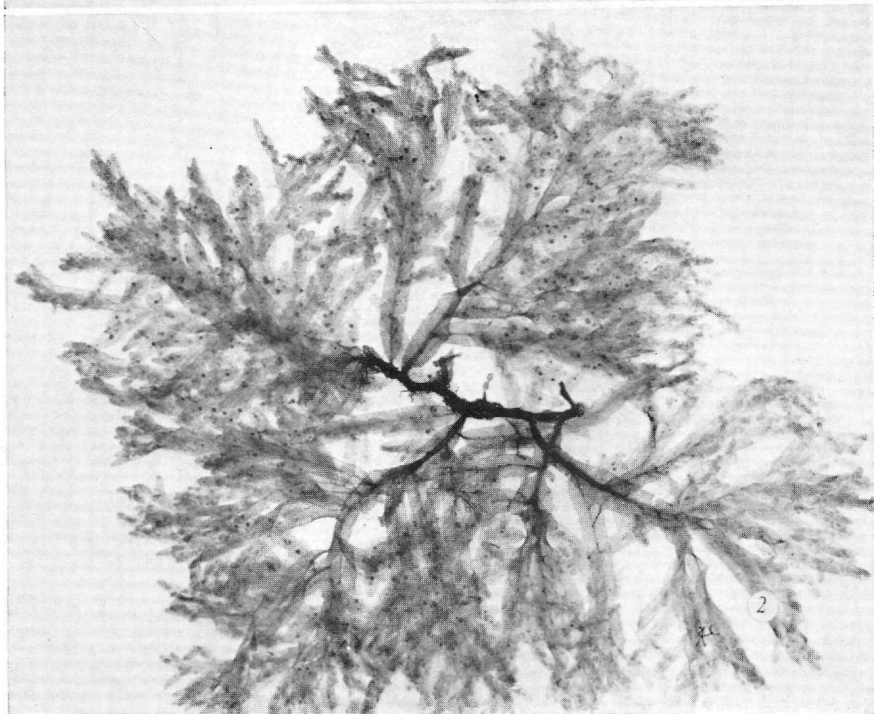
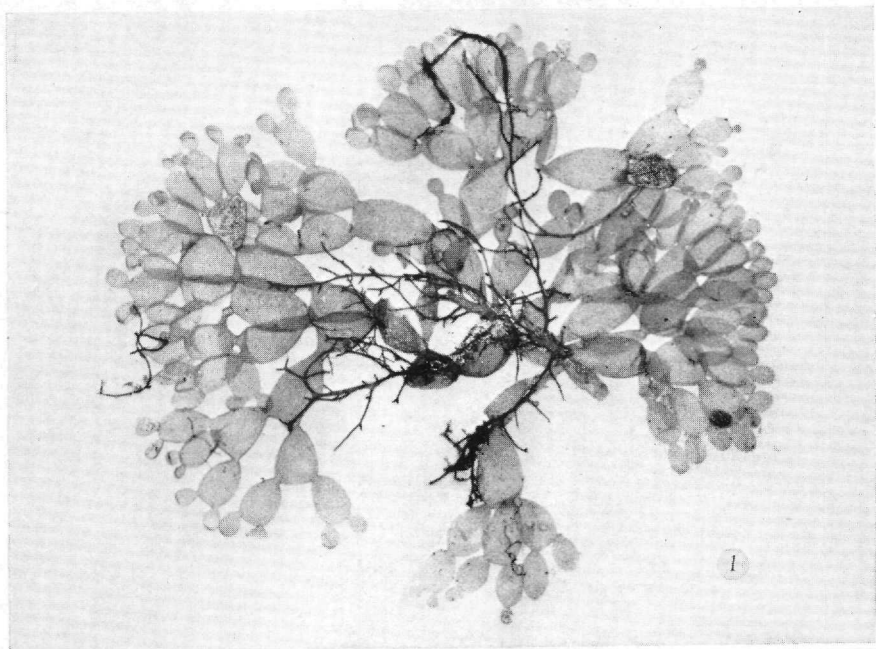
Figs. 1, 2. *Leptofaucha rhodymenioides*. Fig. 1, a small cystocarpic plant showing the marginal position of the fruit, and one branch bearing proliferations. x 1.4. Fig. 2, a larger tetrasporangial plant, showing numerous dark sori. x 1.0. Aruba Island.





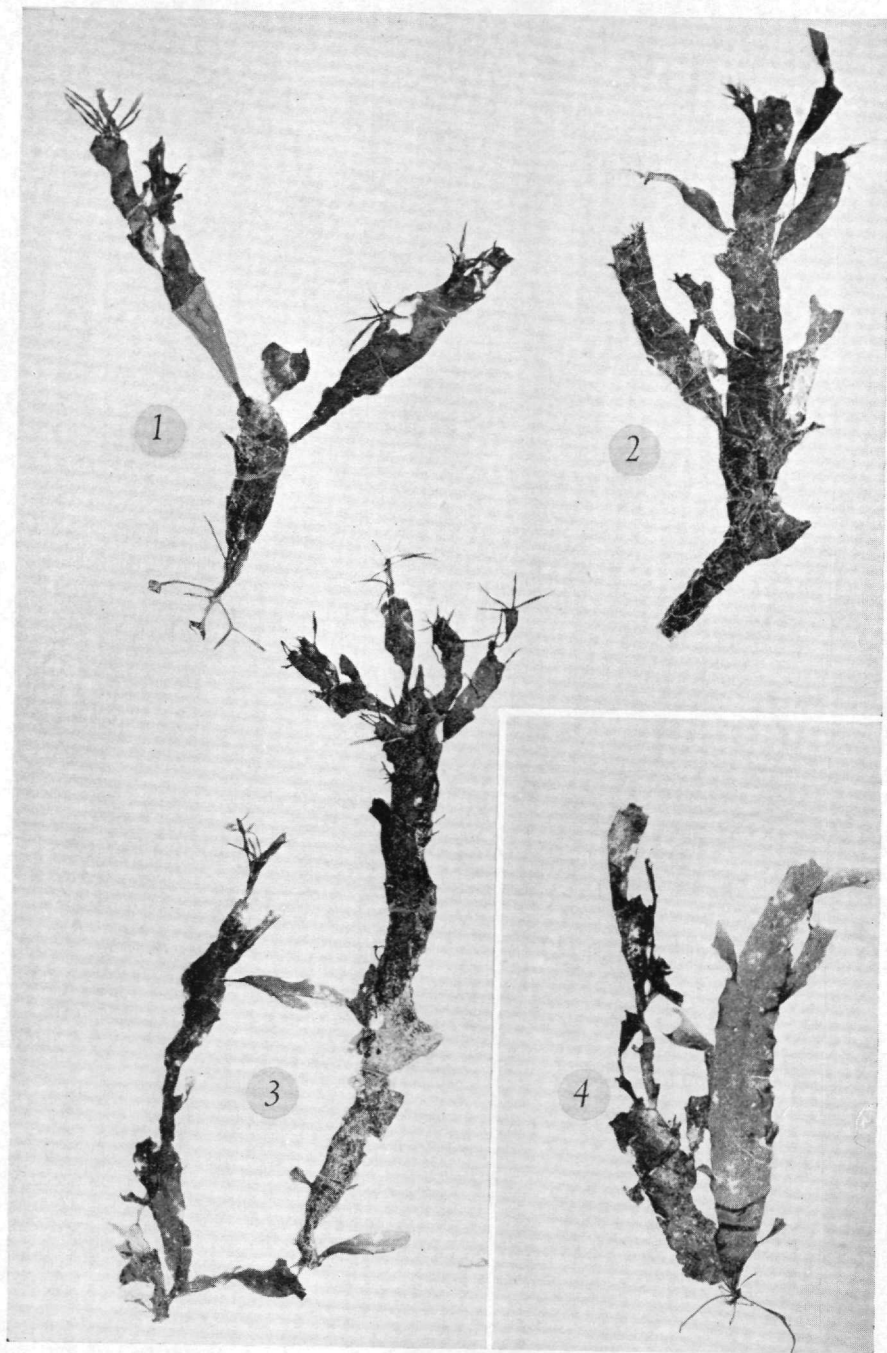
## PLATE 18

- Fig. 1. *Coelarthrum Albertisii*. A plant (with some entangled, dark foreign filaments) showing the form of the segments. Venezuela. x 1.8.
- Fig. 2. *Hypoglossum tenuifolium*. A large cystocarpic plant, showing habit. Venezuela. x 0.75.



## PLATE 19

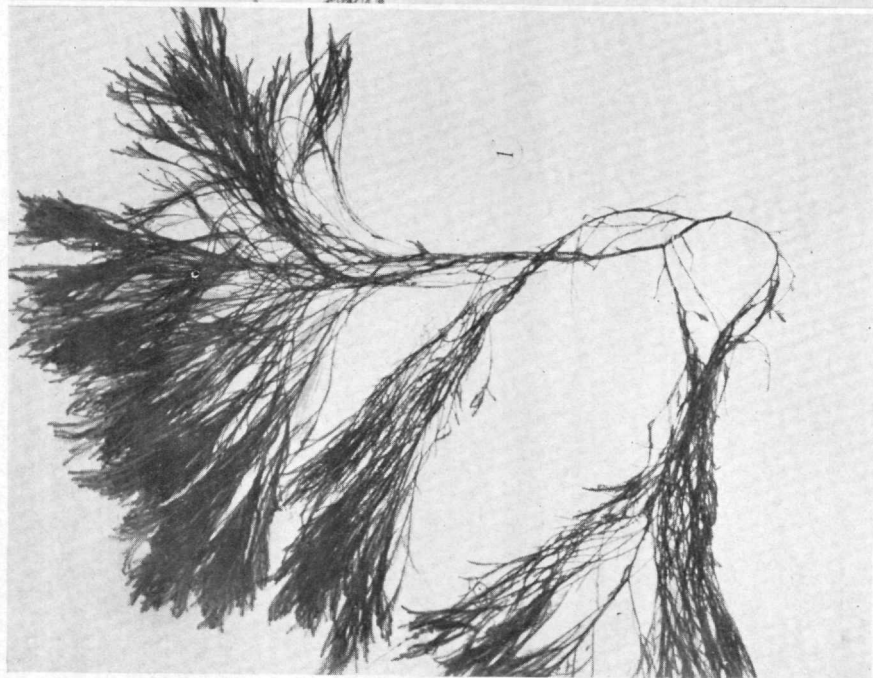
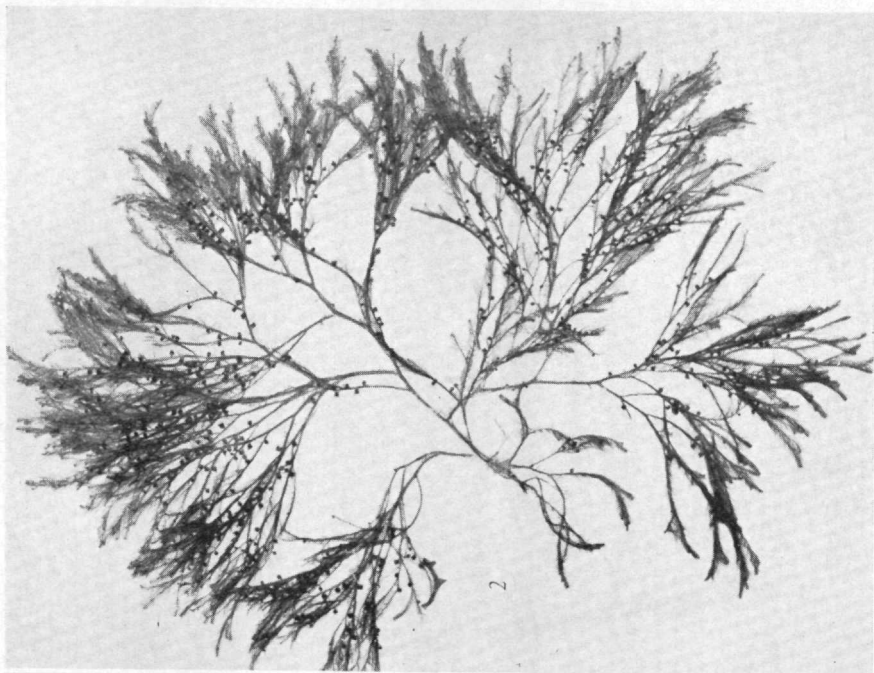
Figs. 1-4. *Cladhymenia lanceifolia*. Portions of four plants. Figs. 1 and 4 show especially the flagelliform strands supplementing the holdfast. Figs. 1 and 3 show the slender proliferations, particularly at the tips of damaged blades. Figs. 2 and 4 show best the form of the primary blades and of the ordinary foliar branches. Colombia. x 1.2.

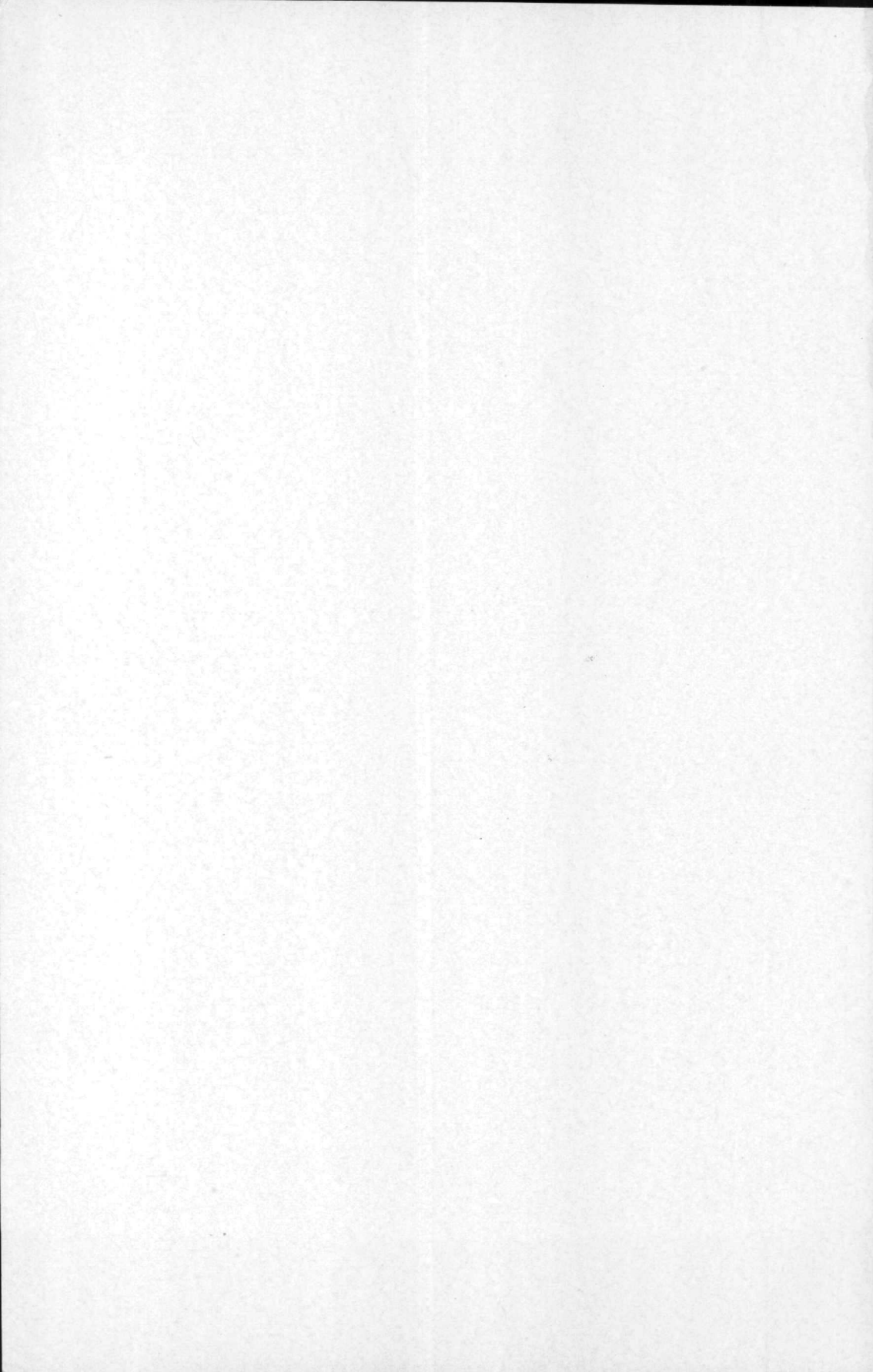


## PLATE 20

- Figs. 1, 2. *Lophocladia trichoclados*. Fig. 1, a portion of a large tetrasporangial plant; these had very erect branching. Fig. 2, portion of a cystocarpic plant; these were not quite so tall, and the branches were formed at wider angles. Venezuela. x 1.3.







# INDEX

Allan Hancock Foundation Publications of The University of Southern California,  
Atlantic Cruise, Report 2. **Place illustrations are in boldface type.**

- ACANTHOPHORA Lamour., 135  
 acerosa (Forssk.) Feldm. & Hamel, Ge-  
 ludiella, 87  
 ACROCHAETIUM Näg., 78  
 aculeata (Schimp.) Kütz., Spyridia, 125  
 AEGIRA Fries, 49  
 aestuarii Gom., Lyngbya, 72  
 AGARDHIELLA Schm., 101  
 Agardhii De Toni, Halymenia, 100  
 Albertisii (Picc.) Børg., Coelarthrum,  
 116, 182  
 Alsidii (Zanard.) Howe, Goniotrichum,  
 75  
 AMANSIA Lamour., 142  
 americana (C. Ag.) Harv. var. cari-  
 baea W.R.T., Grinnellia, 127  
 AMPHIROA Lamour., 94  
 ANADYOMENE Lamour., 20  
 anastomosans, Struvea, 21  
 annulata Dickie, Neomeris, 26  
 antennina, Chaetomorpha, 22  
 antillarum W.R.T., Acrochaetium, 78,  
 150  
 Argus Mont., Wrangelia, 120  
 ASPARAGOPSIS Mont., 86  
 ASPEROCCACEAE, 50  
 atropurpurea Harv., Chondria, 135  
 AVRAINVILLEA Decaisne, 39
- BANGIACEAE, 74  
 Binderi Harv., Bostrychia, 140  
 Binneyi Harv., Polysiphonia, 139  
 BONNEMAISONIACEAE, 85  
 BOSTRYCHIA Mont., 140  
 BOTRYOCLADIA Kylin, 116  
 brachygona Harv., Chaetomorpha, 23  
 brasiliensis (Grev.) Howe & Taylor,  
 Plocamium, 105  
 breviariculatus J. Ag., Ectocarpus, 48  
 BRYOCLADIA Schm., 138  
 BRYOPSISACEAE, 27  
 BRYOPSIS Lamour., 27  
 BRYOTHAMNION Kütz., 136  
 byssoideum Harv., Ceramium, 123
- calcareum (Pall.) Aresch., Lithotham-  
 nion, 93  
 CALLITHAMNION Lyngb., 119  
 CALOTHRIX C. Ag., 69  
 cancellatus, Hydroclathrus, 52  
 capillacea Harv., Jania, 94  
 capitatus Lamour., Penicillus, 43  
 carnea (Dillw.) J. Ag., Erythrotrichia,  
 76
- CATENELLA Grev., 103  
 caudata, Grateloupia, 98  
 CAULERPA Lamour., 28  
 CAULERPACEAE, 27  
 cavernosa (Forssk.) Børg., Dictyo-  
 sphaeria, 19  
 CENTRO CERAS Kütz., 123  
 CERAMIACEAE, 118  
 CERAMIUM Wigg., 122  
 ceranoides, Liagora, 80  
 cervicornis Kütz., Dictyota, 59  
 cervicornis f. spiralis, Dictyota, 60  
 cervicornis (Turn.) J. Ag., Gracilaria,  
 109  
 cervicornis J. Ag., Hypnea, 104  
 CHAETANGIACEAE, 81  
 CHAETOMORPHA Kütz., 22  
 CHAETOPHORACEAE, 15  
 CHAMPIA Desv., 118  
 CHAMPIACEAE, 117  
 CHANTRANSIACEAE, 77  
 CHLOROPHYCEAE, 12  
 CHNOOSPORA J. Ag., 51  
 CHONDRIA C. Ag., 133  
 chordalis, solieria, 102  
 CHORDARIACEAE, 49  
 CHRYSYMENIA J. Ag., 115  
 chthonoplastes Gom., Microcoleus, 71  
 ciliata, Dictyota, 60  
 ciliolata Kütz., Dictyota, 60  
 CLADHYMENIA, 137  
 CLADOPHORA Kütz., 24  
 CLADOPHORACEAE, 22  
 CLADOPHOROPSIS Børg., 19  
 clathratus (Bory) Howe, Hydroclath-  
 rus, 52  
 clavata, Chaetomorpha, 23  
 clavata Kütz., Spyridia, 125  
 clavulatum (C. Ag.) Mont., Centrocer-  
 as, 123  
 coccineum, Plocamium, 106  
 CODIACEAE, 35  
 CODIUM Stackh., 35  
 COELARTHURUM Børg., 116  
 COLPOMENIA Derb. & Sol., 51  
 comoides Gom., Hydrocoleum, 71  
 complanata (Coll.) Cotton, Scinaia, 81,  
 170  
 concatenata, Grateloupia, 98  
 confervoides, Blodgettia, 25  
 confervoides (L.) Grev., Gracilaria,  
 107  
 conglutinata (Sol.) Lamour., Udotea, 45  
 CONTARINIA Zanard., 88

- CORALLINACEAE, 90  
 cornea J. Ag., Gracilaria, 108  
 crassifolia (C. Ag.) J. Ag., Caulerpa, 29  
 crassissima Crouan, Gracilaria, 109  
 crenulata J. Ag., Cryptonemia, 96  
 Crosbyanum Tild., Phormidium, 73  
 crustacea Born. & Flah., Calothrix, 69  
 CRYPTARACHNE Kylin, 116  
 CRYPTONEMIA J. Ag., 96  
 cuneifolia J. Ag., Grateloupia, 97  
 cupressoides (Vahl) C. Ag., Caulerpa, 33, 160  
 cupressoides var. Lycopodium (C. Ag.) Weber-van Bosse, Caulerpa, 33, 160  
 cuspidata (J. Ag.) De Toni, Bryocladia, 139  
 cyclocolpa (Mont.) Schm., Platoma, 101, 170  
 cymosum C. Ag., Sargassum, 65
- damaecornis J. Ag., Gracilaria, 108  
 DASYA C. Ag., 129  
 DASYACEAE, 129  
 DASYCLADACEAE, 26  
 decorticatum (Woodw.) Howe, Codium, 38, 162  
 decutescens (Heydr.) Fosl., Goniolithon, 92  
 DELESSERIACEAE, 126  
 delicatula Mont., Cladophora, 25  
 delicatula Lamour., Dictyopteris, 62  
 delicatulus, Neurocarpus, 62  
 dentata Lamour., Dictyota, 61  
 dichotoma (Huds.) Lamour., Dictyota, 58  
 dichotomum (Huds.) Setch., Codium, 37  
 DICTYOPTERIS Lamour., 61  
 DICTYOSPHAERIA Decaisne, 19  
 DICTYOTA Lamour., 58  
 DICTYOTACEAE, 53  
 DIGENIA C. Ag., 138  
 DILOPHUS J. Ag., 57  
 discoidea Decaisne, Halimeda, 42  
 divaricata Lamour., Dictyota, 60  
 decutescens (Heydr.) Fosl., Goniolithon, 92  
 domingensis, Gracilaria, 109  
 Duchassaingianus Grun, Ectocarpus, 48
- ECTOCARPACEAE, 47  
 ECTOCARPUS Lyngby, 47  
 elachistaeformis Heydr., Ectocarpus, 48  
 elegans, Struvea, 21  
 elongatum, Codium, 38  
 emergens, Acrochaetium, 78  
 ENDODERMA Lagerh., 15  
 ENTEROMORPHA Link, 12
- enteromorphoides Born. & Flah., Hormothamnion, 69  
 ERYTHROCLADIA Rosenv., 74  
 ERYTHROTRICHIA Aresch., 76  
 expansa J. Ag., Ralfsia, 49
- farinosa (Lamour.) Howe, Fosliella, 91  
 farinosa, Melobesia, 91  
 fasciata Delile, Ulva, 14  
 fascicularis (Mert.) Kütz., Cladophora, 25  
 fastigiata, Chnoospora, 51  
 FAUCHEA Bory & Montagne, 113  
 favulosa, Dictyosphaeria, 19  
 ferox J. Ag., Gracilaria, 108  
 filamentosa (Wulf.) Harv., Spyridia, 124  
 filicina (Wulf.) C. Ag., Grateloupia, 97  
 Filipendula C. Ag., Sargassum, 65  
 Flabellum (Ellis & Sol.) Howe, Udotea, 45  
 flabellata, Anadyomene, 20  
 flexuosa (Wulf.) J. Ag., Enteromorpha, 13  
 Floresia (Clem.) C. Ag., Halymenia, 100  
 floridana (Collins) Howe, Chondria, 135  
 floridana J. Ag., Halymenia, 99  
 floridanum J. Ag., Ceramium, 123  
 fluitans Børg., Sargassum, 64  
 fragilissima (L.) Lamour., Amphiroa, 94  
 fragilis, Galaxaura, 84  
 FOSLIELLA Howe, 90  
 FUCACEAE, 63  
 fuliginosa Kütz., Cladophora, 25  
 furcellata, Scinaia, 81  
 fuscescens Gom., Schizothrix, 71  
 fuscus Gom., Porphyrosiphon, 70
- GALAXAURA Lamour., 83  
 GELIDIACEAE, 86  
 GELIDIELLA Feldm. & Hamel, 87  
 gemmifera Harv., Laurencia, 133  
 Gibbsii, Dasya, 141  
 Gibbsii (Harv.) Falk., Heterosiphonia, 141  
 GIGARTINA Stackh., 112  
 GIGARTINACEAE, 112  
 globulifera Harv., Griffithsia, 121  
 GONIOLITHON Fosl., 92  
 GONIOTRICHUM Kütz., 75  
 gorgoneum (Mont.) Born., Hormothamnion, 121, 154  
 GRACILARIA, 106  
 GRACILARIACEAE, 106  
 GRATELOUPIA C. Ag., 97  
 GRATELOUPIACEAE, 96

- GRIFFITHSIA C. Ag., 121  
 GRINNELLIA Harv., 127  
 guineensis (Kütz.) J. Ag., Dilophus, 57  
 gymnospora (Kütz.) Vick., Padina, 56  
 gymnospora, Zonaria, 56  
  
 HALIMEDA Lamour., 39  
 Halliae Collins, Callithamnion, 119  
 HALYMENIA C. Ag., 98  
 halymenioides Harv., Chrysomenia, 115  
 hamatus, Ectocarpus, 48  
 hamulosa, Hypnea, 105  
 Hancockii W.R.T., Amphiroa, 95, 172  
 Hancockii W.R.T., Halymenia, 98, 152, 174  
 Hassleri, Fauchea, 113  
 HELMINTHOCADIACEAE, 79  
 Hendersonii, Phormidium, 73  
 HETEROSIPHONIA Mont., 141  
 HORMOTHAMNION Grun., 69  
 hydroides Gom., Symploca, 72  
 HYDROCLATHRUS, 52  
 HYDROCOLEUM Kütz., 71  
 HYPNEA Kütz., 103  
 HYPNEACEAE, 103  
 HYPOGLOSSUM Kütz., 126  
 Hypoglossum, Delesseria, 126  
  
 incrassata, Halimeda, 40, 41  
 infestans, Acrochaetium, 79  
 intertextum Collins & Herv., Codium, 36  
 intricata (J. Ag.) Børg., Rosenvingeia, 53, 166  
 intricata, Striaria, 53  
 isthmocladum Vick., Codium, 38  
  
 JANIA Lamour., 93  
 Justii Lamour., Dictyopteris, 61  
 Justii, Neurocarpus, 61  
  
 Kernerii Stockm., Rhizoclonium, 24  
  
 Lactuca L., Ulva, 15  
 Lamourouxii Decaisne, Penicillus, 43, 162  
 lanceifolia W.R.T., Cladhymenia, 137, 152, 184  
 latifrons, Scinaia, 83  
 LAURENCIA Lamour., 131  
 Lejolisii (Rosan.) Howe, Fosliella, 91  
 Lejolisii, Melobesia, 91  
 lendigerum, Sargassum, 66  
 leprosa, Liagora, 80  
 LEPTOFAUCHEA Kylin, 114  
 LIAGORA Lamour., 79  
 Liagorae, Acrochaetium, 75  
 linearis (Linn.) Grev., Dictyota, 59  
 lingulata J. Ag., Enteromorpha, 13  
 linifolium (Turn.) C. Ag., Sargassum, 66  
 Linum (Müll.) Kütz., Chaetomorpha, 23  
 LITHOTHAMNION Philippi, 92  
 littoralis Harv., Chondria, 134  
 lobata, Zonaria, 55  
 LOPHOCADIA Schmitz., 140  
 lophoclados, Dasys, 140  
 LYNGBYA C. Ag., 72  
  
 macromeres Coll. & Herv., Spermothamnion, 121  
 Magdae Weber-van Bosse, Contarinia, 88  
 majuscula Gom., Lyngbya, 73  
 mamillaris (Mont.) Howe, Gracilaria, 110  
 marginata (Ell. & Sol.) Lamour., Galaxaura, 85  
 MASTIGOCOLEUS Lagerh., 69  
 media (C. Ag.) Kütz., Chaetomorpha, 22  
 MELOBESIA Lamour., 92  
 membranacea (C. Ag.) Børg., Cladophoropsis, 19  
 membranacea (Esp.) Lamour., Melobesia, 92  
 membranaceum Magnus, Rhodochorton, 79  
 Mertensii, Dictyota, 61  
 mexicana, Caulerpa, 29  
 microcladia Kütz., Laurencia, 132  
 MICROCOLEUS Desmaz., 71  
 Monile (Ellis & Sol.) Lamour., Halimeda, 41  
 mucosa Howe, Neomeris, 26  
 multifida Lamour., Amansia, 142  
 multifida, Nemastoma, 101  
 musciformis (Wulf.) Lamour., Hypnea, 104  
 MYXOPHYCEAE, 69  
  
 natans, Sargassum, 64  
 NEMASTOMACEAE, 100  
 NEOMERIS D'Archiac, 26  
 NEUROCARPUS, 61  
 NITOPHYLLUM, 128  
 NOSTOCACEAE, 69  
  
 oblongata (Ell. & Sol.) Lamour., 84  
 obtusa (Huds.) Lamour., Laurencia, 132  
 obtusata (Ellis & Sol.) Lamour., Galaxaura, 85  
 obtusiloba (Mert.) J. Ag., Vidalia, 142  
 occidentale Fosl., Lithothamnion, 93  
 occidentalis (Børg.) Kylin, Botryocladia, 117



- ocellata Howe, Valonia, 18  
 ocellatum Born. & Flah., Scytonema, 70  
 Opuntia, Catenella, 103  
 Opuntia (L.) Lamour., Halimeda, 42  
 OSCILLATORIAEAE, 70  
 OSTREOBIMUM Born. & Flah., 46  
  
 pacifica J. Ag., Chnoospora, 51, 164  
 PADINA Adans., 55  
 papillosa (Forssk.) Grev., Laurencia, 133  
 parvula (C. Ag.) Harv., Champia, 118  
 pectinata, Amphibia, 140  
 pedicellata (C. Ag.) C. Ag., Dasya, 129  
 peltata W.R.T., Fauchea, 113, 152, 178  
 PENICILLUS Lamarck, 43  
 pennata Lamour., Bryopsis, 27  
 PEYSSONNELIA Decaisne, 89  
 PHAEOPHYCEAE, 47  
 Phoenix, Penicillus, 44  
 Phoenix (Ell. & Sol.) Kütz., Rhipocephalus, 44  
 PHORMIDIUM Kütz., 73  
 PHYLLOSIPHONACEAE, 45  
 pinnata, Caulerpa, 29  
 pinnata W.R.T., Erythrocladia, 75, 150  
 pinnata Harv., Liagora, 80  
 pinnulata, Ahnfeltia, 87  
 Pilgeri Schmidt, Codium, 38  
 plagiogramma (Mont.) Vick., Dictyopteris, 62  
 plagiogrammus, Neurocarpus, 62  
 planifrons, Chrysomenia, 114  
 planifrons (Melv.) Kylin, Cryptarachne, 116  
 PLATOMA (Schousb.) Schmitz, 100  
 platycarpum Mont., Sargassum, 66  
 PLECTONEMA Thur., 72  
 PLOCAMIAEAE, 105  
 PLOCAMIUM Lamour., 105  
 plumaris, Caulerpa, 30, 32  
 plumosa, Bryopsis, 27  
 Poitei (Lamour.) Howe, Laurencia, 132  
 polyceratium Mont., Sargassum, 67  
 polymorpha (Zanard.) Schmitz, Peyssonnelia, 89  
 POLYSIPHONIA Grev., 139  
 porphyroides, Erythrotrichia, 77  
 PORPHYROSIPHON Kütz., 70  
 PRINGSHEIMIA Reinke, 16  
 prolifera (Forssk.) Lamour., Caulerpa, 29  
 PTEROCLADIA J. Ag., 86  
 pteropleuron Grun., Sargassum, 65  
 pulverulenta, Liagora, 80  
 punctatum (Stackh.) Grev., Nitophylum, 128  
 pyriformis (Børg.) Kylin, Botryocladia, 117  
 pyriformis, Chrysomenia, 117  
 pyriformis Gepp, Penicillus, 44  
  
 Quekettii Born. & Flah., Ostreobium, 46  
  
 racemosa (Forssk.) J. Ag., Caulerpa, 33, 160  
 racemosa var. laetevirens (Mont.) Weber-van Bosse, Caulerpa, 34, 160  
 RALFSIA Berk., 49  
 RALFSIAEAE, 49  
 ramosa Dickie, Struvea, 21, 156  
 ramosissima (Harv.) Kylin, Agardhiella, 102  
 ramosissima, Chrysomenia, 102  
 Rawsonii (Dickie) Howe, Avrainvillea, 39  
 repens, Acrochaetium, 78  
 repens (Lightf.) Batt., Catenella, 103  
 repens (Crouan) Vickers, Codium, 37  
 RHABDONIAEAE, 102  
 RHIPOCEPHALUS Kütz., 44  
 RHIZOCLONIUM Kütz., 23  
 RHIZOPHYLLIDAEAE, 88  
 RHODOCHORTON, 79  
 RHODODERMIS Næg.  
 RHODOMELAEAE, 129  
 RHODOPHYCEAE, 74  
 RHODYMENIAEAE, 112  
 rhodymenioides W.R.T., Leptofauchea, 114, 152, 180  
 rigida Lamour., Amphiroa, 95  
 rigida, Gelidiopsis, 87  
 rigidum, Echinocaulon, 87  
 rigidum, Gelidium, 87  
 riparium (Roth) Harv., Rhizoclonium, 24  
 RIVULARIAEAE, 69  
 ROSENINGEA Børg., 52  
 rubra (Grev.) J. Ag., Peyssonnelia, 89  
 rubens (L.) Lamour., Jania, 94  
 rugosa (Ellis & Sol.) Lamour., Galaxaura, 84  
  
 sanctae-crucis Børg., Roseningea, 53, 166  
 SARGASSUM C. Ag., 63  
 Schroederi (Mert.) J. Ag., Spatoglossum, 57, 168  
 SCHIZOTHRIX Kütz., 71  
 SCINAIA Biv., 81  
 scoparia J. Ag., Laurencia, 133  
 SCYTONEMA C. Ag., 70  
 SCYTONEMATAEAE, 70  
 Seaforthii (Turn.) Kütz., Bryothamnion, 136  
 sertularioides (Gmel.) Howe, Caulerpa, 30

- sertularioides f. *corymbosa* W.R.T.,  
     *Caulerpa*, 31, 158  
 sertularioides f. *Farlowii* (Weber-van  
     Bosse) Børg., *Caulerpa*, 31, 158  
*simplex* (Wulf.) C. Ag., *Digenia*, 138  
*simulans* Howe, *Halimeda*, 41  
*sinuosa* (Roth) Derb. & Sol., *Colpome-*  
     *nia*, 51  
*sinuosus*, *Asperococcus*, 51  
*SIPHONOCLODUS* Schmitz, 20  
*SOLIERIACEAE*, 101  
*SPATOGLOSSUM* Kütz., 57  
*spectabile*, *Goniolithon*, 92  
*SPERMOTHAMNION* Aresch., 120  
*spicifera* (Vahl) Børg., *Acanthophora*,  
     135  
*spinella* (C. Ag.) Kütz., *Hypnea*, 105  
*SPYRIDIA* Harv., 124  
*SQUAMARIACEAE*, 88  
*squalida* Kjellm., *Galaxaura*, 84  
*stellata* (Wulf.) J. Ag., *Anadyomene*,  
     20, 156  
*STIGONEMATACEAE*, 69  
*SIRUVEA* Sonder, 21  
*subintegra* Rosenv., *Erythrocladia*, 74,  
     148  
*subtile* J. Ag., *Ceramium*, 123  
*SYMPLOCA* Kütz., 72  
  
*taxifolia* (Vahl) C. Ag., *Caulerpa*, 30  
*taxifolius*, *Fucus*, 32  
*taxiformis* (Delile) Coll. & Herv., *As-*  
     *paragopsis*, 86, 168  
*Teedii* (Roth) Lamour., *Gigartina*, 112  
*tenera* (J. Ag.) Schmitz., *Agardhiella*,  
     102  
*tenue* v. *repens*., *Codium*, 37  
*tenuifolia*, *Delesseria*, 126  
*tenuifolium* (Harv.) J. Ag., *Hypoglos-*  
     *sum*, 126, 182  
*tenuis* Howe & Taylor, *Platoma*, 101  
*tenuissima* (Good. & Woodw.) C. Ag.,  
     *Chondria*, 134  
*terebrans* Gom., *Plectonema*, 72  
*testarum* Born. & Flah., *Mastigocoleus*,  
     69  
*thysigera* (J. Ag.) Schmitz, *Bryocla-*  
     *dia*, 139  
*tomentosum*, *Codium*, 37  
*trialata*, *Turbinaria*, 67  
*Tribulus*, *Amphiroa*, 96  
  
*trichoclados* (Mert.) Schmitz, *Lopho-*  
     *cladia*, 140, 186  
*tricostata* Bart., *Turbinaria*, 68  
*tridens* (Ell. & Sol.) Lamour., *Halime-*  
     *da*, 40, 41  
*tridens*, *Halimeda*, 41  
*triquetrum* (Gmel.) Howe, *Bryotham-*  
     *nion*, 136  
*tropicus* (Crouan) J. Ag., *Siphonocla-*  
     *dus*, 20  
*Tuna* (Ellis & Sol.) Lamour., *Halime-*  
     *da*, 41  
*TURBINARIA* Lamour., 67  
*turbinata* (L.) Kuntze, *Turbinaria*, 67  
  
*UDOTEA* Lamour., 44  
*Udoteae* Børg., *Pringsheimia*, 16  
*ULVA* L., 14  
*ULVACEAE*, 12  
*utricularis* (Roth) C. Ag., *Valonia*, 18  
*Uvaria*, *Chrysomenia*, 117  
  
*vagabunda*, *Erythrocladia*, 75  
*vagans* Børg., *Endoderma*, 15  
*vagum*, *Rhodochorton*, 79  
*valida* (Forssk.) C. Ag., *Liagora*, 80  
*VALONIA* Ginn., 17  
*VALONIACEAE*, 16  
*variegata* (Lamour.) C. Ag., *Zonaria*,  
     55  
*venezuelensis* W.R.T., *Gracilaria*, 110,  
     152, 176  
*ventricosa* (Lamour.) J. Ag., *Chrys-*  
     *menia*, 115  
*ventricosa*, *Halymenia*, 115  
*ventricosa* J. Ag., *Valonia*, 17  
*vexillaris* (Mont.) Hamel, *Erythrotri-*  
     *chia*, 77, 148  
*Vickersiae* Hoyt, *Padina*, 56  
*VIDALIA* Lamour., 142  
*volubilis* Kütz., *Dictyota*, 60  
*vulgare* C. Ag., *Sargassum*, 66  
  
*WRANGELIA* C. Ag., 120  
*Wurdemanni*, *Dasya*, 141  
*Wurdemanni* (Bail.) Falk., *Heterosi-*  
     *phonia*, 141  
  
*ZONARIA* Drap., 54  
*zonalis* (Lamour.) Howe, *Zonaria*, 55  
*Zosteræ* (Mohr) Fries, *Aegira*, 49  
*Zosteræ*, *Castagnea*, 50

